MR. HENRY MAYHEW'S NEW WORK

ON

LONDON AND LONDONERS.

Now Publishing, in Monthly Parts, 1s., *and in Weekly Numbers,* 3d.,

THE

GREAT WORLD OF LONDON:

Its Hard Life, its Easy Life; its Drawing-room and Garret Life; its Industrious, Idle, Business, and Pleasure Life; its Highways, and Byeways, and Slyways; its "Phrases of Worlds," *e. g.*, of Fashion and Vulgo-Gentility, of Science, Art, Letters, Vanity, and Vice; its Lions and Puppies, Sharks and Gulls, Big-Wigs and Small Fry, Philosophers and Fast Men; its Lawyers, Doctors, Parsons, "Magsmen," Soldiers, Servants, Merchants, Shopmen, "Duffers," Authors, Artists, Showmen, Nobles, Swell-Mobsmen, and "Shallow Coves;" Its Palaces and Penitentiaries, Clubs, Merchant-Halls, and Soup Kitchens; its May-Fair and Rag-Fair; its Parks, Railways, Docks, Markets, Belgravia, and "Padding-Kens;" its Exchanges and Banks; its Bill-Discounters, Pawnbrokers, and "Dolly-shops;" its Hundreds of Miles of Streets and Sewers; its Crowds of Carriages and Carts, "Busses," "Cabs," and Coster-trucks; its Law Courts and Judge and Jury Clubs; its Houses of Parliament and "Cogers' Halls;" its Operas, Eagle Taverns, Cyder Cellars, and "Coal-holes;" its Almacks and Argyll Rooms, Spectacles, and "Penny Gaffs;" its Churches, Chapels, May Meetings, and Free-thinking Societies;—in fine, its Everyday and Out-of-the-way Scenes, Places, and Characters.

BY HENRY MAYHEW,

AUTHOR OF "LONDON LABOUR AND THE LONDON POOR."

ASSUREDLY the history and character of the Great Metropolis, in the nineteenth century, is still an unwritten book. There are many clever and learned works on London—regarding it as a vast mass of bricks and mortar—a kind of civic "natural curiosity"—but none as yet viewing it as a huge human "*vivarium*," wherein one learns the habits of the many "odd fish" collected within it.

There are not a few metropolitan topographers who treat of *Old* London, discoursing, pleasantly enough, of the time when "St. Giles's" really stood "in the fields," when St. John's Wood could boast a *few* trees, and when bowls were played in Pall Mall; and telling us, too, how some great dead "lion" was formerly caged in this or that house, and how Watling Street, *in the time of the Romans*, was the high-road to the Provinces that are now reached by the North Western Railway.

Some London historians, on the other hand, are eminently learned concerning the climate and geology of the capital; whilst others, like Mr. McCue-book, are intensely didactic and professorially prosy upon the subject of London Institutions and the London Census.

Of London Scenes, however, and London Society—of London contemplated *morally* rather than physically—as the great centre of human emotion—the scene of its unceasing daily struggles, failures and successes, as well as of the widest passions and the keenest misery; of London, where the very best and the very worst types of civilized society are found to prevail—with its prodigious wealth and enormous commerce—the choice learning, profound science, and high art of some of its people, existing in close companionship, as it were, with the most acute want, and ingrained vice, and brutal ignorance of others—the sweet Christian charity of many, raising palatial hospitals and asylums for the indigent and afflicted, and the bitter stony-heartedness of not a few, grinding, like the Ogre in the story, the bones of their work-people to make their bread;—these, as we have said, are phenomena hardly yet numbered among our literary records, but are matters the chronicles of which surely may be included among the "*desiderata*" of the Great Library of the British Museum.

It is the aspiration of the writer of the work here announced, that he may be able, in some measure, to supply the biblical deficiency, and present to the public such a world-picture of the Great Metropolis as it exists at the present time, that those who are familiar with the scenes and characters described may be pleased with the book for its mere truth, while those who have never visited the places and the people may yet have some ideal sense of them, and so find a picturesque charm in the very peculiarities of the subjects themselves.

THE GREAT WORLD OF LONDON

Will be divided into, and described under, the following Heads:—

Legal London—Medical London—Religious London—Commercial London—Shop London—Literary London—Theatrical London—Fashionable London—Political London—"Out-of-London"—Military London—Nautical London—Market London—Working London—Suburban London—Locomotive London—Street London—Fast London—Poor London—Criminal London—Exhibition London—Musical and Artistic London—Eating and Drinking London—Scholastic London—Foreigners' London—Refuse London—Suburban London—Ancient London—General View of London, etc. etc.

LONDON: DAVID BOGUE, FLEET STREET.

THE TRICKS OF TRADE.

THE

TRICKS OF TRADE

IN THE

Adulterations of Food and Physic;

WITH

DIRECTIONS FOR THEIR DETECTION AND COUNTERACTION.

LONDON:
DAVID BOGUE, FLEET STREET.

MDCCCLVI.

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PREFACE.

The adulterations practised with food may be divided into two kinds—those which are physically harmless, and which only have the effect of defrauding the purchaser; and those which are positively noxious, and not only defraud him, but also endanger his health.

As an instance of innocuous adulteration, we will cite that of butter, in which water, salt, and flour are added, for the purpose of increasing the tradesman's profits, by increasing the weight and volume of the article sold.

As an instance of injurious adulteration, we may mention the sophistication of rum, in which, by way of compensating for the dilution of the spirit by water, *cocculus Indicus* (a berry, containing from one to two per cent. of a poisonous alkaloid called *picrotoxia*) is employed, in order to increase the intoxicating qualities of the spirit.

If, in the former case, the adulteration of food deserves to be treated as a misdemeanour, in the

latter ease it becomes positively criminal, and should be dealt with by criminal tribunals.

Adulteration always implies cheating. It means that the seller, taking advantage either of the confidence or ignorance of the purchaser, substitutes, in the place of the article required, a worthless imitation of it. If, for the sake of extra profit, the dealer adulterates his goods with what he knows to be injurious substances, he places himself in the same category with the man who deliberately poisons another to obtain his property. The former is simply committing in detail the crime which the other perpetrates all at once. The defence usually set up on behalf of the fraudulent tradesman is, the general custom of the trade and his ignorance of the nature of adulterating substances employed. That this ignorance is in most cases assumed there can be no doubt, as the newspapers constantly give cases in which death from sophisticated food and drink occurs. The confectioner who colours his sweetmeats with arsenite of copper (*Scheele's emerald green*) must be well aware that this pigment is of a highly poisonous nature, and yet he never ceases to employ it. The publican, again, from the careful manner in which he makes use of the *cocculus Indicus,* with which he "strengthens" his spirits, must be conscious of its deadly nature; but his love of high profits being restrained by no sense of moral duty, he does not renounce its use.

The use of a book like the present is to expose all "the tricks of trade," which are directed either against the health or the pockets of the community. In France, if the practice of adulteration commenced earlier than in England, its suppression commenced earlier also. There the head of the analyst has been followed rapidly by the hand of the law; and no sooner did the French chemists demonstrate the fatal extent to which numerous articles of diet were being sophisticated, than the French Government occupied itself with the punishment of the adulterators, and directed that the police should use all possible efforts for discovering them. But in England the only protection for the public, under the present *laissez-faire* system of government, is that afforded by publications, in which the means of detecting adulterations are clearly indicated. Any attempt at fraud on the part of the customer is punished by law, and, above all, is easily detected. The bad shilling is at once recognised, and nailed to the counter; but the poisonous adulterations practised upon food remain too frequently undiscovered, until their effects are shown in the indisposition or perhaps serious illness of the consumer.

CONTENTS.

TRICKS OF TRADE

IN THE

ADULTERATION OF FOOD AND PHYSIC.

FOODS SUPPLIED BY THE ANIMAL KINGDOM.

Anchovies.

Bottled Anchovies—Anchovy Paste—Anchovy Sauce.

When some delicate zest is required to make the plain English breakfast more palatable, many people are in the habit of indulging in what they imagine to be anchovies. These fish are preserved in a kind of pickling bottle, carefully corked down, and are surrounded by a red-looking liquor, resembling in appearance diluted clay. The price is moderate, one shilling only being demanded for the luxury. When these anchovies are what is termed potted, it implies that the fish have been pounded into the consistency of a paste, and then placed in flat pots somewhat similar in shape to those used for pomatum. This paste is usually eaten spread upon toast, and is said to form an excellent *bonne-bouche*, which enables gentlemen at wine parties to enjoy their port with redoubled gusto. Unfortunately, in six cases out of ten, the only portion of these preserved delicacies that contains anything relating to anchovy is the

paper label pasted on the bottle or pot, on which the word itself is printed. This we shall do our utmost to prove.

"I have been told," says Dr. Mitchell, "by many parties, that handsome profits are made annually by the manufacture of a spurious anchovy from the common sprat; and not only is this practice not confined to those who sell the fish, but even private families deceive themselves with the idea that "anchovy" sprats are at least as good as the real fish: in most cases they are as good as the fish sold as anchovies, which, indeed, are nothing but prepared sprats. This is, however, easily detected, for the appearance of the two fish is very different. An attentive examination of the form of the anchovy and the sprat will suffice to point out the distinguishing characteristics of each, in such a marked manner, that the fraud is very apparent."

Mr. McCulloch states that the sardine, a fish which is flatter and longer than the anchovy, is frequently substituted for it.

From Yarrell's book on "British Fishes," we learn that "the anchovy is a common fish in the Mediterranean, from Greece to Gibraltar, and was well known to the Greeks and Romans, by whom the liquor prepared from it, called *garum*, was in great estimation. Its extreme range is extended into the Black Sea. The fishing for them is carried on during the night, and lights are used with the nets. The anchovy is common on the coasts of Portugal, Spain, and France; it occurs, I have no doubt, at the Channel Islands, and has been taken on the Hampshire coast and in the Bristol Channel."

Mr. Crouch, speaking of the anchovy, tells us that he has seen it in the Cornish seas of the length of seven inches and a half. It is probable that a fishery might be established with good prospect of success; for though the nets employed for other fish can take but few of them, the numbers found in the stomachs

of the whiting and other ravenous fishes show that they are in considerable abundance.

The anchovy is immediately recognised among the species of the family to which it belongs, by its sharp-pointed head. The upper jaw is considerably longer than the lower. The length of the head, compared to the length of the body alone, is as one to three; the depth of the body about two-thirds of the length of the head, and, compared to the length of the whole fish, is as one to seven; the breadth of the eye is one-fifth of the length of the whole head; the scales of the body are large and deciduous; the colour of the top of the head and back blue, with a tinge of green; irides, gill-covers, sides, and belly silvery-white; the fins delicate in structure, and greenish-white; the membranes connecting the rays almost transparent.

When the anchovy is bottled, the head and intestines are removed. The fish is of small size, silvery, and rather flat; the line of the back slightly curved, and the flesh is usually of a pink or salmon colour. If an anchovy be three months old, it is of a pale colour; if six, it is pink; but if twelve months, the pink becomes almost red.

Dr. Hassall states that, out of twenty-eight samples of anchovies examined by him, he found that seven of them consisted entirely of Dutch Fish. Two of the samples consisted of a mixture of Dutch fish and anchovies. Nearly all of the bottles contained either French or Sicilian fish, which, from their close resemblance to the true anchovy, are sold as "real Gorgonas." The brine in twenty-three of the samples was tinged with either bole Armenian or Venetian red, the quantity considerable in amount; but in most cases the brine was saturated with these earthy powders to such an extent, that "they might be obtained and collected from the bottom of the bottles almost by teaspoonfuls."

Mr. John Simon, in his examination before the Committee on the Adulteration of Food, stated that,

happening to be in a large pickling establishment, he saw a person busily employed in chopping up fish, and observing a keg of red stuff by his side, he asked permission to look at it. The man was slicing his fish on a reddened slab, and obviously this pigment was intended for admixture with the fish. He was told it was Venetian red, and that the public did not like their anchovies unless they were coloured.

The Venetian red and bole Armenian, with which it is the practice to colour the brine, are earths which, althongh they may not have any immediately injurious effects, are nevertheless unpleasant, and not exactly suited to help digestion or render a meal more attractive. The negroes of Guinea eat clay, and consider the flavour of it very agreeable, but in England we do not look upon dirt as an article of food. Besides, when a customer has paid a certain sum for what he is told is fish, he does not expect to have placed in his hand a bottle containing enough colouring earth to manufacture a moderately sized pot of paint.

In potted anchovies, where we have no longer the shape of the fish to guide us as to genuineness, the manufacturer has an almost unlimited power of adulteration. All the samples of anchovy paste that have been analysed by different medical men, have been found to be highly and even vividly coloured with very large quantities of bole Armenian. Flour is also employed as an adulterating ingredient.

The essence of anchovies, so much used in this country for flavouring the melted butter which is usually served up with fish, is almost invariably coloured with bole Armenian.

The anchovy itself, when imported, is of a dark dead colour, and it is to make it a bright "handsome-looking sauce" that this red earth is employed. According to Mr. Blackwell, of the firm of Crosse and Blackwell, the wholesale pickle manufacturers, the largest proportion of bole Armenian used is ten

pounds to 100 gallons of anchovy sauce, or about one per cent. In anchovy paste, a quarter of an ounce of the pigment is used to 36 pounds of fish. Of late, this firm has renounced the use of bole Armenian, and they confess that the taste of the uncoloured and less attractive-looking sauce is much superior to that which they formerly manufactured.

For the benefit of those who prefer knowing what they eat, we copy into our pages the receipt given in "The Cook's Oracle" for making pure "anchovy sauce." We need not point out that bole Armenian does *not* form one of the ingredients :—

"Put ten or twelve anchovies into a mortar, and pound them into a pulp; put this into a very clean iron or well-tinned copper saucepan; then put a tablespoonful of cold spring water into the mortar, shake it round, and pour it to the anchovies. Set them over or by the side of a gentle fire, and stir them frequently till they are melted; then add a quarter of a drachm (avoirdupois) of Cayenne; let it remain by the fire a few minutes longer; then, while warm, rub it through a hair sieve with the back of a wooden spoon."

Butter.

Butter is the name given to the fat and unctuous substance obtained from cream by churning. During this operation there is an increase of temperature, amounting to about three or four degrees; oxygen gas is absorbed, and an acid is consequently generated. For some time, the making of butter was supposed to depend upon the absorption of oxygen, but that it is not an essential part of the process, is proved by the fact that butter may be obtained by churning even when atmospheric air is entirely excluded.

Butter usually contains about one-sixth of its weight in buttermilk. When rendered rancid by keeping, it is exceedingly injurious to the dyspeptic, and it is

partly in order to conceal this rancidity that the buttermen adulterate their butter with salt. That a certain amount of salt is necessary for preserving butter is true, but when considerably more than the required amount is added, the public have a right to look upon the process as one of adulteration. The purchaser is also in almost every case cheated by having butter sold to him with which a large amount of water has been mixed, in order to give weight. Water is stirred up with the butter while it is in a semi-fluid state, and thus becomes incorporated with it.

Formerly butter was adulterated with flour, and also with lard; but it was found, in an examination of forty-eight different samples, that none of them were adulterated with anything but water and salt. The salt butters examined contained variable, but usually very large, quantities of water, the amount ranging from nine to twenty-nine per cent. The fresh contained less water than the salt butters, the amount ranging from four to fifteen per cent. The salt in the salt butters varied from $1\frac{1}{2}$ to $8\frac{1}{4}$ per cent., while that in the fresh butters varied from $\frac{1}{3}$ to three per cent. Some of the samples contained twenty, thirty, and in one case nearly thirty-five per cent. of water and salt.

Hence it appears that no real saving is effected by purchasing the compound known as salt butter; besides which, the butter is frequently only salted when it is too rancid to be sold without a large proportion of the salt being added to it. Mr. Miller, formerly in the butter-trade, states, in a letter to the *Lancet*, that butter is adulterated to a much greater extent than is generally supposed. "The adulterating process," he writes, "is to bring the butter to the melting point, then to stir it in water and salt until the mixture is cold. Fifty per cent. of water may be incorporated with butter in this way; but when you make your purchase, say half a pound, a considerable part of the water of adulteration will escape, and if you put it in paper, considerably more will be lost. If

the public adopt your suggestion of testing their butter, they will discover the truth of what I have above said, that twenty-six per cent. of adulteration in these butters is less than the average amount.....The trade would all be glad to give up the sale of adulterated butter, if a public movement were made so as to compel all the shopkeepers to do so at the same time. N.B.—Forty thousand to fifty thousand casks of adulterated butter are annually sold in London, and the trade know it as well as they know a bad shilling."

"Epping butter," it appears, from another letter in the *Lancet*, is made in the following manner:—Irish salt butter of a very inferior quality is taken; this is repeatedly worked with water, in order to free it from the salt. The next process is to wash it frequently with milk; the manufacture being completed by the addition of a small quantity of sugar. The result is styled "Epping butter;" the sale of which yields the ingenious manufacturer a profit of one hundred per cent., while his shop gets the credit of being supplied with genuine Epping butter from the first-rate dairies.

Sir John Gordon, the present mayor of Cork, has given some valuable evidence before the Adulteration of Food Committee, relative to the frauds practised in the sale of butter. A very large quantity of butter was brought to him, which appeared to have been merely curds mixed with a certain quantity of butter. It was made in the neighbourhood of Cork, and brought to market in firkins. It was sold at the price of good butter. The party who bought it detected the fraud, and reported it to the mayor, who had it seized and destroyed, having first made the party pay back the money he had received for the sale of it.

Butter is the principal article of trade in Cork. The small farmers in the neighbourhood who cannot fill a cask, send in 18 lbs. or 20 lbs. at a time, and this is bought by parties who afterwards cask it, when they have a sufficient quantity. Sometimes this butter is mixed with a strong paste.

In order to ascertain the amount of water present in a given sample of butter, melt the butter, pour it into a bottle, place the bottle by the fire, and let it remain there until the water and salt have, from their superior weight, fallen to the bottom. The amount of real butter contained in the specimen will, of course, be seen floating at the top, and, generally speaking, will be found alarmingly small.

Butter, although nutritive, is still insufficient alone to support animal life. In the report of the Gelatine Commission of the French Academy of Sciences, it is stated that a dog fed on fresh butter only, continued to eat it, irregularly, for 68 days. He died subsequently of inanition, although in a remarkable state of *embonpoint*. During the whole of the experiment he exhaled a strong odour of butyric acid, his skin felt greasy, and his hair was unctuous and covered with a fatty layer.

Cheese.

Cheese is made from milk which has been curdled by means of an acid or by rennet—a fluid obtained by infusing the inner coat of a calf's stomach in hot water. Milk in this state consists of a solid coagulum called curd, and a limpid fluid, which is whey. When the curd has been collected together, and is subjected to a strong pressure, to expel any remaining whey, it is permitted to dry and harden, and in that condition it constitutes what is called cheese. The richness of cheese is in proportion to the quantity of butter present. "Rich cheese," says Pereira, "when toasted, undergoes a kind of semi-fusion, and becomes soft and viscid. The poorer cheeses, or those which contain very little butter, are better adapted for keeping. When toasted they shrivel like ham.

Stilton cheese is prepared from milk, to which cream is added. Cheshire and the best Gloucester

cheeses are made from unskimmed milk. Suffolk and Parmesan cheeses are prepared from skimmed milk. When the cream has been skimmed for three or four mornings, a hard indigestible cheese is made from the milk, which is known by the name of "Suffolk bank." These cheeses are so hard, that to cut them it is requisite to use an axe. The people say, that pigs grunt at them, dogs bark at them, but neither of them dare bite them.

Cheese is sometimes adulterated, but there is only one case on record of red lead having been found in it, and that was traced to the annatto, which is the colouring matter employed for imparting a creamy yellow colour, and which had been adulterated with red lead. Such annatto having been used for colouring the curds, the cheese was, of course, poisoned, and Dr. Normandy mentions that a gentleman who partook of it, nearly lost his life in consequence. This annatto is a vegetable colouring substance, which is largely used in dyeing, and also in colouring cheese, butter, and cream. It is a very expensive substance, and on that account is usually adulterated. For this purpose chalk, wheat flour, turmeric, salt, bole Armenian, and red lead are principally used.

Cheese is subject to the attacks of both animals and vegetables. The fly called *Musca* (*Tephrites*) *putris* deposits its copious larvæ, or maggots (called hoppers or jumpers), on cheese. The cheese-mite (*Acarus domesticus*) is another animal of frequent occurrence. The mould of cheese is composed of minute fungi.

Connoisseurs usually prefer an old cheese which has become decayed and mouldy. In order to impart this aged appearance to a new cheese, the merchant often inoculates it with a small portion of the blue mould taken from an old one. The fungi, to which this blue decay is owing, soon spreads, and in a short time imparts to the recently manufactured article a close resemblance to a cheese that has been kept a long time. This practice cannot, however, be

termed fraudulent, for the effect produced by this inoculation is precisely similar to that caused by age.

In some parts of England it is a custom to stick pins into a new cheese, or to force copper coins into the sides, to produce this blue mould. This practice is both silly and dangerous. The metal would only make a local stain, for the blue mould of cheese is, as we have said before, owing to a minute fungi. All the salts of copper are poisonous, and although the amount of metallic oxide deposited in a cheese treated in this manner might not be sufficient to produce any immediate effect, still there can be no doubt that such cheese would, in time, be excessively detrimental to health.

Lard.

Lard consists of the oily portions of the fat of swine. It is obtained on a large scale by melting down the fat, by means of steam introduced beneath large iron caldrons. As it melts readily—the fusing point of different varieties varying from 79° to 88°—it soon liquefies, and floats on the surface, whilst the tissues and animal matter of the fat either form scum, which is from time to time skimmed off, or sink to the bottom as a deposit. Whilst the lard is yet in a fluid condition, it is drawn off from the copper, and received into either bladders or small casks. Such lard is known in the trade as bladder and keg lard, the former being the more valuable.

When lard is pure, it should be of a perfectly white colour, and have neither taste nor smell. On applying a moderate heat, it should resolve itself into a clear transparent liquid.

Lard is frequently adulterated to a great extent, principally with farinaceous substances. Mr. George Whipple states, in the *Pharmaceutical Journal* (January, 1853), that this adulteration has been discovered in the different varieties of lard, from the finest

bladder to the common firkin lard. In an examination of the contents of two firkins, weighing 105½ lbs., a quantity of farinaceous substance, amounting to 22¼ lbs., was separated. The contents of another firkin, weighing 43¾ lbs. yielded 12¾ lbs. of a similar substance.

Mr. Calvert published some further observations on the adulteration of lard, in the same journal. "During the numerous analyses I made some years ago," he writes, "of various articles of food employed in public establishments, I analysed several samples of American lard, and therefore may add to the fact already mentioned by Mr. George Whipple, that I found them to contain, in addition to starch, from ten to twelve per cent. of water, and from two to three per cent. of alum, and about one per cent. of quick-lime."

The adulterations described by Mr. Calvert are performed in the following manner:—The fatty matters, such as they arrive from America, are melted with a little water in false-bottomed copper pans, through which circulates a current of steam. The dirt and other heterogeneous matters fall to the bottom of the pans, and the clear grease is allowed to run into a wooden vessel, where it is stirred in contact with cold water; it is then put under revolving wheels, with a thick paste made of potato starch, mixed with a little potash, alum, and quick-lime, which appear to facilitate the taking up of the water and starch by the fatty matter. The American lard arrives unadulterated in this country, and it is to our own manufacturers alone that the impurity of the article as sold is to be attributed.

Alum is employed in doctoring lard; partially to increase the weight, but also to prevent the starch from becoming mildewed. The manufacturer also adds it for the purpose of increasing the whiteness of the confectioner's paste, in which it is largely used.

Another method of adulterating lard, is by mixing that of an inferior quality, and consequently soft, and

easily affeeted by an inerease of temperature in the atmosphere, with a small quantity of mutton suet, whieh is a hard and firm fat, and has the effect of hardening the lard, and making it keep better.

The lards shipped from Ireland, Hamburgh, and Ameriea almost invariably arrive in England in a pure and genuine eondition; but if, on their way to London, they have unfortunately passed through Liverpool or Bristol, then they are nearly certain to have "had tricks played with them," and to have been adulterated with water and potato flour, often to an enormous extent.

The easiest method of discovering whether lard is adulterated by having water or salt mixed up with it, is to melt it at a heat of 212°. If it dissolve without ebullition—caused by the eseape of watery vapour or steam—or without leaving a deposit, it may be eonsidered genuine. If ebullition oecur, or if a sediment be thrown down, the lard is, beyond doubt, adulterated.

In order to ascertain the quantity of water with whieh the lard has been adulterated, a small quantity should be accurately weighed, and exposed to a heat of 212° until bubbles of vapour eease to escape; the per eentage of water will be shown by the amount of weight lost. The presenee of stareh may be deteeted by thoroughly ineorporating a small quantity of lard with a solution of iodine, when, plaeed on a slip of glass, it will turn blue or blaek. Starch may also be discovered by means of the mieroscope.

To determine the amount of saline matter present in lard, melt it, eolleet the precipitates, and separate them, by eleansing with ether, from any oil which may remain with them, and they ean then be weighed, and the salt, soda, alum, or lime will at onee be recognised by the taste.

Inferior lards are adulterated much more than those of the best quality. It is said to be impossible to adulterate a lard of good quality, whieh eommands a good priee, and whieh is spoiled by tampering.

Dr. Hassall thus sums up the evil effects of using lards which are largely adulterated :—

"In the presence of large quantities of potato flour the cook will find a sufficient explanation for the extraordinary tenacity with which the fish sometimes adheres to the frying-pan. Again, the use of such lard might in some instances prove even of serious consequence by impeding its action. Lastly, the activity of all the ointments of the Pharmacopœia made with such a lard would be much injured, especially the simple and compound iodine ointments, which, if starch were present, would turn blue or almost black, in the act of incorporation."

Lard, like all pure animal fats, does not contain sufficient nutrition to support life. From Magendie's experiments we learn that animals which at first ate it greedily, subsequently refused to touch it, and, after a shorter or longer use of it, died. "We tried," says Magendie, "whether, by mixing a certain portion of bread with the lard, we could ameliorate its effects. We made a paste composed of 120 grammes of lard to 250 of white bread, but the animal that was submitted to this nourishment refused it, after a few days' use of it.

By dyspeptic patients lard should be especially avoided. The influence of heat on fatty substances effects various chemical changes in them, whereby they are rendered very difficult of digestion, and more obnoxious to the stomach. As we have before stated, lard is nothing more than the oil of swine's fat extracted by heat.

Potted Meats and Fish.

The potted tongue and ham sold in shops are generally free from adulteration, most probably because they are red meats; for the principal object of adulterating potted meats and fish seems to be to mix

them with some substance which will impart to them a red colour.

Potted beef is, in nine cases out of ten, coloured by means of bole Armenian.

Potted herrings generally contain bole Armenian to a very great extent, and are also frequently adulterated with flour and starch.

Anchovy paste appears to be even more adulterated than the potted meats (for an account of which the reader is referred to the article *Anchovies*).

Meat that has been coloured with bole Armenian can, even when the adulteration is small, be readily detected by its peculiar appearance. It has a deep, earthy, brick-dust red, utterly different from the natural colour of the meat, which presents a pale pink hue. When it is difficult to detect the presence of bole Armenian with the naked eye, the microscope may be resorted to, and then the red, earthy particles will easily be distinguished. The presence of bole Armenian will, if existing, be also discovered by shaking up the suspected paste in water, when the earthy matter will fall to the ground and form a sediment.

The active chemical substance in bole Armenian is oxide of iron. It is rarely used in medicine, but when taken, it has a tonic and rather stimulating effect. But we must remember that bole Armenian has, in some instances, been found to be adulterated with red lead; and the presence of this active and fatal poison has been more than once detected in potted meat and fish.

FOODS SUPPLIED BY THE VEGETABLE KINGDOM.

ARROW-ROOT.

THIS substance is a very pure white powder, obtained from the roots or tubers of the *Maranta arundinacea*, a native of the West India Islands. It was called "arrow-root" because it was supposed by the Indians to be a specific against wounds inflicted with poisoned arrows. The word is now widely employed to designate any kind of fecula which resembles the true or Maranta arrow-root, no matter how dissimilar the tubers may be from which it is extracted. It makes a tolerably strong jelly, stronger than that from wheat starch, and is free from colouring matter, and also from any unpleasant taste or odour. Dr. Prout considers it as a low variety of starch, analogous to the "low sugar of honey;" while wheat starch he regards as the most perfect form of starch, analogous to sugar-candy. It is employed as a nutritious, easily digested, agreeable diet for invalids and infants. "Arrow-root pudding for invalids," writes Dr. Pereira, "is prepared by beating the yolks of two eggs and half an ounce of sugar together, and stirring the mixture into a pint of arrow-root milk."

Arrow-root, taken alone, as an article of diet, is insufficient to support life; in order to give strength it requires an admixture of what chemists call gluten, in some form or other, for the nutritive quality of every variety of grain depends upon the proportion of gluten which it contains. "To condemn a prisoner," writes Professor Johnston, "to be fed upon arrow-root alone, would be to put him to a certain death by a lingering, torturing starvation."

The method employed in Jamaica for extracting the starch from the tubers is thus described by Dr. Pereira, in his "Materia Medica:"—

"The tubers are dug up, well washed in water, and beaten to a pulp in large, deep, wooden mortars; this is thrown into a large tub of clean water. The whole is then well strained, and the fibrous part wrung out by the hands, and thrown away. The milky liquor being passed through a hair sieve or coarse cloth, is suffered to settle, and the clear water then drained off. At the bottom of the vessel is a white mass, which is again mixed with clear water and drained; lastly, the mass is dried on sheets in the sun, and is pure starch."

What is called British or English arrow-root is made from potatoes. It greatly resembles in appearance the genuine Maranta arrow-root, for it is a glistening powder, and crackles when pressed between the fingers. This substance is very cheap, and is retailed in shops at prices varying from fourpence to sixpence per pound. It is greatly used by grocers for mixing with and adulterating the finer and more expensive qualities of arrow-root.

In Portland Island, large quantities of arrow-root are manufactured from the tubers of the *Arum maculatum*, the well-known cuckoo-pint, wake-robin, and lords and ladies.

What is sold as Maranta arrow-root is nearly always adulterated by having potato flour or potato arrow-root mixed up with it. The microscope is the most satisfactory means of discovering the fraud, for the granules of potato differ from those of the genuine arrow-root, by being larger and differently shaped, resembling somewhat in appearance the form of an oyster. Another means of analysis is to mix the suspected article with twice its weight of concentrated hydrochloric acid, which has the property of forming a transparent jelly with Maranta, and an opaque paste with potato arrow-root.

The retail price of Maranta arrow-root varies from 3*s.* 6*d.* to 1*s.* per pound. As we said before, potato arrow-root may be obtained for 4*d.* and 6*d.* per pound, the advantage to be gained by the seller by adulterating the one with the other is therefore evident.

Bottled Fruits.

The property of copper solutions in imparting a permanent and vivid green colour to the liquid used in preserving vegetable substances, has been largely and poisonously taken advantage of by the manufacturers of bottled fruits.

The quickest test for the presence of this poison is the eye. Whenever the colour is brilliantly green, it may be safely concluded that the use of such fruit would be dangerous, because it contains copper. In all the samples of genuine bottled fruits, the colour is almost of a dirty yellow, with a slight tinge of green.

The quantity of copper contained in such articles may not be sufficient to produce fatal effects on all constitutions, but serious symptoms of gastric irritation are sometimes produced on children which may assume an alarming character. Some preserved gooseberries, sent by a friend to Professor Taylor for examination, were found to be largely impregnated with copper; indeed, the poison was present in sufficient doses "to cause colic and vomiting," and the other painful symptoms of chronic poisoning in its most aggravating form.

In his examination before the Adulteration Committee, Dr. Hassall mentioned another instance of this poisonous adulteration. A gentleman wrote to the *Lancet*, giving his name and address, and stating that he had partaken at dinner of some rhubarb tart, which he had noticed presented a very peculiar appearance, for it was much more green than it should

be. He partook of it with suspicion, but still did eat some of it; and on accidentally casting his eyes down and looking at his fork, which was of steel, he found the prongs covered with copper."

The gratitude of the public towards Dr. Hassall ought to be both great and lasting, for the philanthropic patience with which he has examined into the adulterations of all articles of food. That gentleman, after analysing forty different samples of bottled fruits, came to the terrible conclusion that (with only one single exception) all of them were contaminated with copper.

The easiest method of detecting the presence of this metal is to pour off from the bottled fruit a small portion of the syrup into a wine-glass, and add to it a few drops of strong ammonia. If the solution turn blue, the copper is present in large quantities. Sometimes the liquid is impregnated with such small portions of the metal that this test fails. But if, as Professor Taylor recommends, a bright clean needle be suspended in the fluid, and allowed to remain there for some time, the steel will become coated with a distinct film of copper. Iron has the peculiar property of reducing copper from its salts. This test has answered even when the metallic salt present was less than the six-thousandth part of the solution. "When the quantity of copper is small, the red colour of the deposited metal is not always perceptible, it appears brown or black, and the deposit may be obscured, from its being mixed with some oxide of iron. When we are in doubt, the needle should be placed in a weak solution of ammonia, and exposed to the air. The liquid will soon acquire a blue colour, if any metallic copper be present."

As we have said before, this poisonous adulteration is practised only to render the appearance of the preserved fruits more attractive, and also to enable them to retain their brilliant colour for an indefinite period,

so that they may be always saleable. Fortunately, it is one of those adulterations which do not add to the profits of the manufacturer, and we may therefore hope that in a short time it will be utterly done away with; for, as nothing is gained by the fraud, no doubt the dealer will consent—since the late exposures—to indulge in an honesty which will cost him nothing.

FLOUR.

Flour is, according to the general acceptation of the word, the fine white powder obtained by crushing and grinding wheat, and from it bread, such as is eaten in England, is (or ought to be) made. Owing to the large quantity of gluten which it contains, wheat is more nutritious than the other cereal grains. Gluten is, as its name implies, the glutinous matter which is found in several alimentary substances. It is easy of digestion, and highly nutritious. The experiments made by Magendie prove that, even when given alone, it is capable of supporting life. He gave it without any preparation or seasoning, and it excited neither repugnance nor disgust in the dogs who, for a long period, partook of it. "It is the presence of gluten in wheaten flour," says Magendie, "that renders it pre-eminently nutritious."

According to Davy, the wheat of warm climates abounds more in gluten and in insoluble parts, and it is of greater specific gravity, harder, and more difficult to grind. From this it would appear, that the grain imported from the Danubian provinces and Egypt is of greater alimentary value than that which is produced in England.

Flour is not so much adulterated as might have been expected, from the fearful extent to which adulteration is carried in the manufacture of bread. The falsifications practised by the millers principally consist of mixing bad flour with good. Pereira, how-

ever, states (1850) that wheat flour is subject to adulteration with various vegetable and mineral substances. Among vegetable substances, he names the following: potato starch, the meal of other cereal grains (viz., of maize, rice, barley, and rye), of buck-wheat, and of certain leguminous seeds (viz., of beans, peas, and vetch).

The numerous other substances which have been used to adulterate wheat flour are chiefly chalk and sulphate of lime—plaster of Paris. White clay and bone-ashes are also said to have been used. Sulphate of copper and alum are mixtures added to buck-wheat flour to improve its quality, and render it more fitted for making bread.

Dr. Normandy, in his "Handbook of Chemical Analysis," tells us that the substances principally employed for the purpose of adulterating wheat flour are potato or fecula starch, bean flour, Indian corn, rye and rice flour, which alimentary substances are objectionable only when the flour containing them, or the bread made with such flour, is sold as genuine wheat flour or bread; but besides these, so far venal additions, flour is sometimes sophisticated by alum, chalk, bone-dust, and plaster of Paris, and it is more especially against these that the rigour of the law should be enforced.

A common adulterating practice is to mix up flour that, through dampness, has suffered decomposition, with the better qualities of flour. This composition is always sold as the best flour. Flour has a great affinity for water; when kept in a damp place it will absorb from 18 to 20 per cent. of moisture. If the water is present in large quantities, the flour clots and cakes together, and fermentation quickly sets in, in consequence of which the gluten is destroyed, it loses its nutritive properties, and acquires a musty odour. Sir J. Gordon, the mayor of Cork, once met with an instance of this kind. The flour had been warehoused in England for such a length of time, that

it became decomposed and worthless. It was sent over to Ireland, and there it was found to be unsaleable; but by mixing it with a certain quantity of pollard and a small quantity of sound flour, it was sold in this state. When analysed, it was discovered that the gluten was entirely decomposed. Those who ate of it suffered from violent gastric affections, and were attacked with purging and sickness of the stomach. Another notorious instance of this species of adulteration took place in Scotland. The flour was supplied to Government, under a contract, and in order to conceal its decomposed condition, it was mixed up with about one-third of its weight of sound oatmeal.

In the town of Cork the mayor is empowered, by a local act, to examine into the condition of all food exposed for sale, and to punish all attempts at adulteration, either by fining the offender, or by seizing the falsified goods. Every three months, a market jury of twelve is appointed, whose duty it is to visit the shops and warehouses, and inspect the quality of the articles offered for sale. The good that has been worked under this act has been immense. Corn stores have been visited, when the grain has been found to be in a complete state of decomposition. It had suffered at sea, and a particular insect became so numerous in it, that when they died they absolutely produced the smell of animal decomposition.

Nearly every description of farinaceous matter is mixed with flour. Cheap grain is imported from all portions of the globe, for the express purpose of adulterating wheaten flour. According to Sir J. Gordon, an Egyptian grain, called *dari*, was at one time imported into Ireland in large quantities, and disposed of to millers. Its price was about £6 a ton, while wheat flour was bringing nearly three times that amount. Pea-meal and bean-meal have also been known to be mixed with flour.

To neutralize the acid tendency in some kinds of

moist flour—particularly in that which is imported from America,—bicarbonate of soda is mixed up with it. This adulteration is not practised in this country. Whenever it has occurred, it has been found that the alkali, although manufactured in England, had been sent to America, and added there.

There is no doubt that flour, before it is ultimately made into bread, suffers a double adulteration. First of all, the miller adds either a cheaper material, or mixes with it some chemical substance, for the purpose of improving the appearance of his goods. Thus the miller frequently adulterates his flour with alum, and the baker again adulterates it, by putting a little more to it. Some authorities assert that the millers supply the bakers with flour at different prices, and that there is some at so low a value, that the baker is necessarily aware that it cannot be genuine. In fact, the baker gets his flour cheaper in consequence of its falsification, and he is fully aware of it.

Flour used formerly to be adulterated with bone-dust; but at present, owing probably to the increased value of bone-dust for purposes of manure, and the diminished price of flour, this adulteration is seldom or never practised.

A very excellent method of ascertaining the amount of adulteration practised in flour is that recommended by Dr. Ure, by means of specific gravity, which indicates the compactness of a substance or the quantity of ponderable matter contained in a body, compared with the space which it occupies. For instance, if it is supposed that potato flour has been added to the wheat flour, since a vessel which contains one pound of wheat flour will contain one pound and a half of the fecula, the proportion of this adulteration may be readily estimated.

When flour is suspected of adulteration with bone-dust, its presence can be readily detected by means of the microscope. In a sample of flour adulterated with bone-dust, and examined with that instrument,

particles and fragments will be visible, in some of which bone-cells and other structure characteristic of bone will be discovered. Phosphate of lime, which enters so largely into the composition of bone, may be detected in the following manner:— Burn the suspected flour in a crucible, and weigh the ash left after incineration; if it form considerably more than one and a half per cent. of the flour so calcined, then it is certain that it is adulterated with some organic substance. If a portion of the ash dissolved in water give, with nitrate of silver, an abundant precipitate, and if a considerable quantity of lime be detected by means of oxalate of ammonia (which will also produce a white precipitate, soluble in excess of nitric acid), the foreign substance is proved to consist of phosphate of lime.

To detect the presence of plaster of Paris, some of the suspected flour should be incinerated in a crucible, and the ash left after the burning weighed. If the greater portion of this ash is soluble in a strong solution of potash, and a dense precipitate falls on the addition of ammonia to the solution, it consists of the earth in question—alumina, or the oxide of aluminium.

For directions for detecting the presence of alum, with which flour is said to be sometimes adulterated, see article *Bread.*

Biscuits, Rusks, etc.

Rusks, and tops and bottoms, belong to the class of fermented breads. Both are made with wheat flour, butter, sugar, milk, and a considerable quantity of yeast to give them lightness. Although they are frequently employed as infant food, they are objectionable not only on the ground that they contain butter, and are fermented, but also because the butter with which they are made is frequently of impure quality.

The captain's biscuits sold in the shops are professedly unfermented, and made of wheaten flour and water, with a small portion of butter. Some bakers, however, employ a little yeast, in order to render the product less dense. The common butter biscuit is rendered light by the yeast which it contains; it also, as its name indicates, contains butter. In the preparation of Abernethy biscuits, yeast is generally used. The small square York biscuit is prepared with wheaten flour, butter, milk, and sugar, but without yeast. Those biscuits which contain butter are more objectionable for dyspeptics than plain biscuits.

Gingerbread is made from flour, treacle, butter, common potash, and alum. After the butter is melted, and the potash and alum are dissolved in a little warm water, these three ingredients, along with the treacle, are poured among the flour, which is to form the basis of the bread. The whole is then thoroughly incorporated together by mixture and kneading into a stiff dough. This dough, however thoroughly kneaded, almost invariably requires to stand over for the space of from three or four to eight or ten days, before it arrives at the state which is best adapted for its rising to the fullest extent, and becoming duly gasified in the oven.

The alum, which possesses such injurious qualities (see article *Bread*), is the least essential ingredient, although it is useful in having a decided tendency to make the bread lighter and crisper, and in accelerating the tardy period at which the dough is in the most advantageous condition for being baked. Several kinds of light biscuits owe their lightness to sesquicarbonate of ammonia (volatile or smelling salts), which is dissolved in the water used in the formation of the dough. When the whole salt has been nearly evaporated, the texture of the dough has become sufficiently stiff and dry to prevent the mass shrinking to its former dimensions.

As examples of unfermented biscuits, in the manufacture of which sesquicarbonate of ammonia is used, may be mentioned Cracknells, and the Victoria and Clarence biscuits. Cracknells are prepared with wheaten flour, a small quantity of sugar, a little milk, butter, eggs, and the sesquicarbonate of ammonia. The curl of the oak-leaved Cracknells is produced by the latter salt. The Victoria contains, besides the smelling salt, flour, eggs, sugar, milk, and butter. The Clarence biscuit contains some eggs and a few caraway seeds.

The adulterations in biscuits consist almost entirely of the adulteration in the flour and sugar with which they are made. (See articles *Flour* and *Sugar*.)

Bread.

When the wheat is put into the mill it is crushed between two stones, by which process the flour is separated from the whole husk or bran. In the ordinary mode of bread-making, the baker mixes together water, a little flour, and yeast, and sets the mixture aside for six or eight hours to undergo fermentation. The fermented mixture is called the *sponge;* its formation and abandonment to spontaneous decomposition is termed *setting* the sponge, and according to the relation which the amount of water in the sponge bears to the whole quantity to be used in the dough, it is called *quarter*, *half*, or *whole* sponge.

According to Dr. Pereira, the yeast or leaven causes the sugar of the flour to undergo the vinous fermentation, by which carbonic acid and alcohol are formed. It is not improbable that the fermentation is promoted by the starch, a proportion of which may perhaps yield an additional quantity of sugar. The carbonic acid is prevented from escaping by the tenacity of the dough, which, becoming distended with gas, swells up and acquires a vesicular texture, forming a kind of spongy

mass. In this way therefore are produced the vesicles or eyes, which give to ordinary loaf-bread its well-known lightness and elasticity.

In well-baked bread the vesicles are stratified in layers, which are perpendicular to the crust; forming thus what bakers term *piled* or *flaky* bread. The tenacity of the dough, on which the vesicular structure of the bread depends, is owing to the gluten. If the vinous fermentation be not checked in due time by baking, the dough becomes sour, owing perhaps to the formation of both acetic and lactic acids. After being put into the oven, the fermentation and swelling are at first increased by the elevated temperature, but when the whole has been heated nearly to the temperature of boiling water, the fermentation is suddenly arrested, and the mass is fixed by the after-baking in the form it has then attained.

"In the formation of wheaten bread," says Sir H. Davy, "more than one quarter of the elements of water combine with the flour; more water is consolidated in the formation of bread from barley, and still more in that from oats; but the gluten in wheat, being in much larger quantity than in other grain, seems to form a combination with the starch and water, which renders wheaten bread more digestible than other species of bread."

The common salt used in bread-making serves principally to flavour the bread, but it also gives stiffness to the dough.

The adulterations of bread consist principally of the introduction of alum; sometimes it is used in large quantities. In bread that has been carelessly mixed, a crystal of alum has been discovered the size of a large pea, and in other cases large crystals of alum have been found. To the poor, whose daily food consists almost entirely of bread, this shameful adulteration is productive of much hardship. The working man, instead of finding in his daily allowance

the nourishment which he pays for, gets, on the contrary, an enfeebled power of digestion, and, consequently, an inferior power of performing work.

The effect of the alum is to augment the whiteness and firmness of bread made from inferior kinds of flour. Home-made bread has a yellowish tinge, which alum would remove. The use of alum is forbidden by law, but it is frequently employed, under the name of "*stuff*." Whatever doubts may be entertained as to the ill effects of alum on the healthy stomach, none can exist as to its injurious effect in cases of dyspepsia.

Potatoes are also largely employed as an adulterating ingredient. As they contain less gluten, they are, of course, less nutritive than wheat flour, but in other respects their use is unobjectionable. Dr. Normandy, in giving his evidence before the Parliamentary Committee on the adulteration of food, drinks, and drugs, stated that the adulteration with alum was generally practised in bread of second and third qualities (which were generally bought by the poorer classes), for the sake of giving a white appearance to the bread, to make it appear as if made with the first flour, and to add to the weight. The alum being used forced into the bread a large quantity of water. He had detected 500 grains of alum in a four-pound loaf, and 150 in a loaf of lighter weight; but generally 25 to 30 grains in a pound loaf.

The effect of bread and flour so adulterated upon the constitutions of children is most prejudicial. Boiled rice is also used, to absorb an enormous weight of water. A few years ago, a patent was taken out, and worked at the Marylebone workhouse, for making bread, by introducing into it a large proportion of boiled rice. Rice flour is frequently added to bread, in order to increase its capacity for taking up water. The admixture of rice flour cannot be used to injure the consumer, but it certainly cheats him of a certain

amount of nutritious wheat farina, the place of which is supplied by water.

Several cases have occurred in which powdered alum taken in large doses has caused death. Orfila has found that alum, if taken in considerable quantities, acts fatally on animals, destroying life in a few hours. At present, the only means of avoiding the daily consumption of a certain amount of alum is by buying the best bread at the most respectable bakers. The second and third qualities of bread are simply the first qualities adulterated.

Alum acts chemically on the animal tissues and fluids. If a solution of it in water be added in certain proportions to albumen, it causes a white precipitate. It also forms insoluble combinations with milk and gelatine.

These phenomena explain the action of alum on the fibrinous, albuminous, and gelatinous constituents of the living tissues.

A simple test for detecting the presence of alum in bread, is to allow portions of the crumb of bread to soak in water for a few hours. If some diluted white of egg is then added to this water, the solution should, if the bread has been adulterated with alum, turn slightly opaque, the milkiness varying according to the quantity of alum present in the loaf.

The immediate topical effect of a solution of alum is that of an astringent, it causes the smaller vessels in the body to contract. By diminishing the diameter of the blood-vessels, it checks the supply of blood, and so produces paleness of the parts. It is by these local effects that "alum,* when taken internally, causes dryness of the mouth and throat, somewhat increases thirst, checks the secretions of the alimentary canal, and thereby diminishes the frequency, and increases the consistency of the stools, as observed by Wibmer in his experiments made on himself with

* Pereira's Materia Medica.

alum, in doses of *three grains,** dissolved in five drachms of water, and taken several times during the day."

"But when alum is applied to a part in large quantities, and for a longer period, the astriction is soon followed by irritation, and the paleness by preternatural redness. And then, taken internally in large doses, alum excites nausea, vomiting, griping, purging, and even an inflammatory condition of the intestinal canal—*effects which may be, perhaps, indueed by small quantities in persons endowed with unusual or morbid sensibility of the stomach and bowels, as in the case of a lady in whom dangerous gastro-enteritis was apparently indueed by a single dose of a solution containing between ten and twenty grains of burnt alum.*"

Sulphate of copper, when used in small quantities, has a peculiar whitening effect upon bread, and it also enables it to retain a great quantity of water. It is much used in Belgium, but in England the bakers, we are happy to say, prefer alum.

The only objection that can be made to the use of potatoes for adulterating purposes, is the sufficiently valid one, that they are made to take the place of a much more nutritious substance. The presence of potatoes may be readily detected with the microscope, from the peculiar form of the starch-corpuscles, which closely resemble the shape of an oyster.

The quantity of salt used in the preparation of bread is six or eight times greater than that of alum. From five to six pounds are added to every sack of flour, so that each quartern loaf contains upwards of an ounce of salt, the use of which in large quantities is said, by medical authorities, to be anything but conducive to health. It lessens the amount of the secretions, and at the same time produces heat and thirst.

* A person who eats a four-pound loaf of bread daily swallows, according to Dr. Normandy, Mitchell, and others, quantities of alum varying from 150 to 50 grains.

Carbonate of magnesia is added to bread in order to give whiteness to the flour, and to make the dough take up an increased amount of water. From twenty to forty grains of magnesia are put to every pound of flour, and the use as an article of food of an earthy and insoluble substance, such as magnesia, is of course attended with injurious consequences.

The adulteration of bread is an offence punishable by law; but although it is next to impossible to go into a baker's shop and obtain pure bread, and although true weight is a thing almost equally unknown, still it appears that these robbers of the public money and destroyers of the public health are not considered fit subjects for prosecution by the Chancellor of the Exchequer. The secret of the exemption of bakers and other tradesmen from well-merited punishment and exposure, while the illicit distillation and sale of spirits is sometimes made the subject of prosecution of an almost vindictive character, is to be found in the fact that in the latter case the Exchequer suffers, whereas in the former the public at large are the only victims. In order to convince our readers that the fraudulent baker is not only morally but even legally criminal, we append an abstract from M'Culloch's "Dictionary of Commerce," in which the state of the law with regard to the adulteration and weight of food is clearly set forth.

Under the Assize Act, bakers are restricted to bake any but three kinds of bread, viz., wheaten, standard wheaten, and household; the first being made of the finest flour, the second of the white flour mixed, and the third of the coarser flour.

Bakers or sellers of bread are bound to have fixed in some conspicuous part of their shops a beam and scales, with proper weights, for weighing bread, and a person purchasing bread may require it to be weighed in his presence. Bakers and others sending out bread in carts, are to supply them with beams, scales, etc.,

and to weigh the bread if required, under a penalty of not more than £5.

Bakers, either journeymen or masters, using alum or any other unwholesome ingredients, and convicted on their own confession, or on the oath of one or more witnesses, to forfeit not exceeding £20 and not less than £5 if beyond the environs of London, and not exceeding £10 and not less than £5 if within London or its environs.

Any ingredient or mixture found within the house, mill, stall, shop, etc., of any miller, mealman, or baker, which after due examination shall be adjudged to have been placed there for the purpose of adulteration, shall be forfeited, and the person within whose premises it is found punished, if within the city of London and its environs, by a penalty not exceeding £10 nor less than £40 for the first offence, £5 for the second offence, and £10 for every subsequent offence; and if without London and its environs, the party in whose house or premises ingredients for adulteration shall be found shall forfeit for every such offence not less than £5 and not more than £20.

According to the process of manufacturing bread in France, it is exceedingly difficult to commit frauds. When bread is adulterated in France, which occasionally is the case, the baker, if found out, is at once summoned before the police. If it is the first offence, he is fined, or if the offence has been very gross, his shop is shut up for a week or ten days, or even a longer period; and if the offence is repeated, he is prevented from following his trade as a master baker. He may, if he chooses, go to work as a journeyman baker, but he is never again permitted to keep a shop. The sentence is placarded about the town, together with the nature of his offence. In fact, for a French baker to adulterate his bread, is to run the risk of being ruined.

Cakes, Pastry, etc.

Cakes, of which the plum-cake may be taken as the type, may be regarded as a rich variety of bread, though, in common parlance, they are considered distinct from this. They are composed of wheaten flour, butter or lard, eggs, sugar, raisins, currants, almonds, etc. They form a most indigestible kind of food, totally unfit for children, invalids, and dyspeptics. Their indigestible quality is principally derived from the butter or lard which they contain. The adulterations in cakes, etc., consist almost entirely of the adulterations in the flour, sugar, butter, or lard with which they are made. (See articles *Flour*, *Sugar*, *Butter*, and *Lard*.)

Sugar.

Sugar is an abundant vegetable product formed in nearly all ripe fruits, though few of them contain it in sufficient quantity for being collected.

The juice which flows from incisions made in the trunk of the American maple tree is so powerfully saccharine that it forms a considerable article of commerce. The four States of New Hampshire, Vermont, New York, and Michigan produce together upwards of twenty millions of pounds, and the Canadas together about seven millions of pounds of maple sugar. The average yield of each tree is considered to be about one pound. In France, Germany, Belgium, and Russia immense quantities of sugar are made from beet-root. It is reckoned that upwards of 362 millions of pounds of this sugar are manufactured in these four countries.

But by far the greater portion of sugar at present used in Europe is obtained from the sugar-cane (*Arundo saccharifera*), which contains it in greater quantity than any other plant. Stolle has estimated

the total amount of sugar extracted from the sugar-cane over the whole world to amount to 4527 millions of pounds. Of this the greater amount comes from the British East and West Indies. The consumption in England amounted, in 1853, to 818 millions of pounds, or 28 pounds per head.

The sugar-cane is a native of China. It is supposed to have been first taken to the West Indies by the Spaniards, about the year 1520.

The process of making sugar, as practised in the West India Islands, consists in evaporating the juice of the ripe cane, by a moderate and cautiously applied heat, until it has attained a proper degree of consistence for crystallizing. During the operation lime-water is added, partly for the purpose of neutralizing free acid and partly to facilitate the separation of extractive and other vegetable matters, which unite with the lime, and rise as a scum to the surface. When the syrup is sufficiently concentrated, it is drawn off into shallow wooden coolers, where it becomes a soft solid mass, composed of loose crystalline grains. It is then put into barrels with holes in the bottom, through which a black ropy juice, called molasses or treacle, gradually drops, leaving the crystalline sugar comparatively white and dry.

This raw sugar has to undergo another process to convert it into what is called white or loaf sugar. It is boiled with albumen, for this substance, on the application of heat, solidifies and forms fibres and meshes, which, being lighter than syrup of sugar, rise and in their upward course carry away with them the solid impurities, which collect as a scum on the surface.

Formerly the sugar-refiners performed this operation by means of bullock's blood, that substance containg a great quantity of albumen. But we are glad to say that this disgusting custom is gradually becoming extinct, and that white of egg or pure albumen is now generally employed.

Pure sugar is entirely composed of carbon, or char-

coal, and water. This may be proved by a simple and interesting experiment. If a few drops of strong sulphuric acid be placed on a lump of loaf sugar it will almost immediately be turned to a deep black, for this acid having a strong affinity for water, unites with that in the sugar, and leaves the pure charcoal behind.

Pure sugar is solid, white, inodorous, and of a very agreeable sweet taste. It is hard and brittle, and when two pieces are rubbed together in the dark, phosphorescence is observed.

Sugar is alone incapable—as an article of diet—of preserving the health and life of animals. Magendie found that dogs fed exclusively on sugar and water died in from thirty-four to thirty-five days. He also states, in confirmation of the above, that in 1793 five sailors, on board of the wreck of a Hamburg vessel, had subsisted for nine days on sugar and a small quantity of rum, and that they were found by a French vessel in a most debilitated state (the youngest excepted). The three oldest died shortly afterwards.

But sugar when eaten in a raw state—that is to say, in the condition in which it exists in the cane—is an excessively nutritious substance, because it then contains, besides its sugar, a considerable quantity of gluten, as well as of those necessary mineral substances which are present in all our staple forms of vegetable food. During the sugar season of the West India Islands, Dr. Wright, in his "Medicinal Plants of Jamaica," says, "every negro on the plantations, and every animal, even the dogs, grow fat."

The injurious effects which have been ascribed to sugar are more imaginary than real, for some individuals have consumed large quantities of it, for a long series of years, without suffering any ill consequences. We are told that Henry Duke of Beaufort, who died about 1702, ate nearly a pound of sugar daily for forty years. He died of fever, in the seventieth year of his

age. He was never troubled with cough, his teeth were firm, and all his viscera were found, after death, quite sound.*

The fondness of children for saccharine substances, Dr. Pereira informs us, may be regarded as a natural instinct; since nature, by placing it in milk, evidently intended it to form a part of their nourishment during the first period of their existence. Instead, therefore, of repressing this appetite for sugar, it ought rather to be gratified in moderation. The popular notion of its having a tendency to injure the teeth is totally unfounded.

This opinion is further supported by Dr. Wright, who says, "It has been alleged that the eating of sugar spoils the colour and corrupts the teeth; this, however, proves to be a mistake, for no people on the earth have finer teeth than the negroes in Jamaica."

It is probable, therefore, that this erroneous notion originated with mothers, who, finding the weekly sugar bill increase by the indulgence, framed a theory of their own to deter their children from enjoying the expensive luxury.

The impurities of sugar are either organic or inorganic.

The organic impurities consist of fragments of the cane, grape-sugar, albumen, an insect peculiar to cane-sugar, fungi, woody fibre, and starch-granules.

The inorganic impurities have been found to consist of lime, lead, iron, sand, and grit. All of these impurities arise from the imperfect preparation of the juice before allowing it to crystallize. Grape-sugar is a low sugar, deficient in sweetening powers, therefore it is evident that by admixture with grape-sugar, that of the cane must be greatly depreciated in value.

Dr. Pereira states that brown sugar is exten-

* See Dr. Slare's Vindication of Sugar, p. 59. London, 1715.

sively adulterated with sugar prepared from the potato-stareh as well as with that made from sago-flour (these substanees are analogous with grape-sugar). Potato-sugar is manufaetured at Stratford, in Essex. It is clammy, and wants that sparkling erystalline appearance possessed by West India sugar, is mueh less sweet than the latter, and possesses a bitter, somewhat unpleasant taste.

We have above stated that one of the impurities of sugar was an inseet peeuliar to the juice of the cane. The diseovery of this animaleule is due to Dr. Hassall,* who was the first to employ the microscope in his researches into the adulteration of sugar. We eannot do better than borrow his deseription of it. This insect is a beetle-like animaleule, of the genus *Acarus*.

"The sugar aearus approaehes somewhat, in organization and habits, to the louse and the iteh-inseet itself, whieh are also included in the genus *Acarus*. The sugar mite is in size so eonsiderable that it is plainly visible to the unaided sight. When present in sugar it may be detected by the following proceeding:—Two or three teaspoonfuls of sugar should be dissolved in a large wine-glass of tepid water, and the solution allowed to remain at rest for an hour or so; at the end of that time the animaleules will be found, some on the surfaee of the liquid, some adhering to the sides of the glass, and others at the bottom, mixed up with the dark and copious sediment.

"The body is oval, or rather somewhat ovate, being broader behind than before. From its posterior part proeeed four long and stiff bristles, two together on each side, and some eight or ten smaller ones are arranged nearly at equal distances around the eireumferenee of the body; from its anterior part a proboscis of eomplex organization proeeeds, and from its inferior surfaee eight legs, jointed and furnished with spines or hairs at eaeh articulation; the spine which issues from the last joint but one of eaeh leg is very

* Food and its Adulterations, page 17.

long, and extends much beyond the termination of the leg itself. Lastly, each leg is armed at the extremity with a formidable hook."

The *acarus sacchari* clings to life with great tenacity, for warm water does not always kill it. Hence, those who sweeten their drinks with brown sugar *must* swallow several of these disgusting insects in a living state, for the heat of the beverage is not sufficient to destroy them.

For the consolation of our readers, we are happy to announce that this insect is never found in purified, i. e. lump sugar. It owes its existence and nutriment to the albumen which, as we said before, is always present in inferior sugars.

Another inconvenience arising from the presence of these *acari* is mentioned by Dr. Hassall. It is well known that grocers are subject to an affection of the skin, denominated "grocers' itch," of which one of the symptoms is extreme irritation and itching. To this disease all grocers are not equally liable, but those particularly who are engaged in the "handling" of the sugars, as the warehousemen. Now the *acarus sacchari* actually belongs to the same genus as the *acarus scabiei*, or itch-insect, than which it is larger, and possessed of an organization still more formidable and forbidding.

The lime to be found in sugar may be traced to this circumstance: — Lime is, during the manufacturing of sugar on the plantations, used for the purification of the cane-juice, and as brown sugar does not undergo any filtration, a portion of the lime used may very commonly be detected in such sugar.

There is also a frequent complaint, that the finely crystallized or white sugar is occasionally by no means sweet. This is entirely owing to the quantity of lime —usually about one per cent.—which, from carelessness in the manufacture, and from imperfections in the purifying process, gets mixed up with the saccharine matter, and forms with it a chemical combination.

The presence of lead and iron in lump sugar is explained by the fact that vessels made of these metals are used during the refining process to which the raw material is subjected.

Dr. Hassall (whose inquiries are certainly the most valuable that have as yet been made into the condition of sugar as sold in the shops, and whose discovery of the sugar animalcule entitles him to the greatest respect as an authority), to test the purity of grocers' brown sugar, purchased thirty-six samples at different parts of the metropolis, and subjected them to a careful analysis. He found that fragments of cane were present in all the sugars except one, which had evidently been purified by filtration, so as to approach in character to refined or lump sugar. *That the disgusting-looking acari were present in thirty-three out of the thirty-six sugars*, and in nineteen cases in very considerable numbers. That sporules of fungus are almost invariably present in brown sugars. That grape-sugar was detected, often in considerable amount, in the whole thirty-six sugars. That the whole of the sugars contained vegetable albumen. That woody fibre and grit were in nearly all the samples. That a variable quantity of *starch* or *flour* was contained in each sample, and that in *four* of the sugars the amount of flour was so considerable that it had evidently been employed for the purpose of adulteration.

Many persons have imagined that sand is largely employed by grocers to adulterate their sugars. But tradesmen are not so foolish as to use a material so easily detected. As sand is insoluble in water, it is very easy to satisfy this suspicion; for, on pouring hot water on the sugar it would be dissolved and the sand, if any is present, left behind. When "grit" is found, it has been imported into England from the plantation where the sugar was manufactured, and invariably arises from the imperfect cleansing of the canes before being carried to the pressing mills.

In an examination of fifteen samples of lump

sugar, of different qualities and price, it was found that in none of the sugars were fragments of cane present, these having been separated by the filtration through charcoal, to which sugar in process of refinement is subjected. That in no case were *acari* observed. That a grape-sugar was in three cases detected; and that in none of the sugars were sporules of fungi to be seen.

The principal method of adulterating sugars at present employed by grocers is by "handling," as it is called; that is, by mixing inferior and cheap sugars with those of good quality and high price.

The easiest means of detecting this adulteration is by the appearance of the sugar itself. A fine sugar is light coloured, highly crystalline, and very dry. Impure sugars are dark coloured, imperfectly crystalline, small grained, often presenting an earthy appearance, and they are, in addition, damp and heavy.

"We feel compelled," writes Dr. Hassall, in the *Lancet*, "however reluctantly, to come to the conclusion *that the brown sugars of commerce are, in general, in a state wholly unfit for human consumption.*"

Lump sugar is free from the greater part of the impurities and adulterations which contaminate and deteriorate brown sugar; it does not contain *acari*, fungi, grape-sugar, albumen, or grit. We recommend therefore the more general use of refined or lump sugar.

The great question is whether it is cheaper to pay fourpence a pound for a mixture of insects, mould, water, and saccharine matter, or to give sixpence for an equal weight of the crystalline substance called loaf sugar, which is an article of commerce more useful, from its stronger sweetening powers, more pleasant to the eye, from its colour and brilliance, and more consoling to the consumer, from the certainty that it contains no living creatures concealed within its intersticcs.

Sweetmeats.

Of late years the number of shops for the sale of sweetmeats has very much increased. In poor neighbourhoods, where there are always children running about the streets, there is scarcely a street without one or two of these shops.

In large and frequented thoroughfares, such as Tottenham Court Road, Houndsditch, or High Street, Whitechapel, these establishments are made as showy as possible; they burn a vast quantity of gas, and have their windows filled with sugar compounds, many of which have been moulded into fanciful and highly coloured forms. Sometimes the image represented is a mutton-chop or a rasher of bacon; onions and potatoes are very popular; and eggs, oysters, dogs, shoulders of mutton, pears, and mackerel are also much esteemed by the youthful customers.

In all these works of art, it is not so much the elegance of form or pleasant associations of ideas that are deemed requisite for a speedy sale, as a close imitation both of form and colour. Hence, sugar onions, potatoes, and shoulders of mutton are generally more highly esteemed and inquired after than sugar strawberries, apples, or oranges.

When Dr. Pereira affirms sugar is a wholesome food for children, and that their passion for it ought to be gratified in moderation, he is speaking of refined or loaf sugar, and not of the adulterated compounds, smeared with poisonous paints, vended at these sweetmeat shops.

Most of the sugar with which cheap lozenges and these fanciful representations are manufactured is adulterated with either starch, chalk, or clay.

Dr. Thomson, like all those who have made inquiries into the composition of sweetmeats, has found that they are adulterated to a very great extent. He pro-

cured from a large manufactory a great many specimens of different kinds of comfits, at various prices. Those which are in the trade called mints, and which were sold at 7*d.* per pound, contained nearly four per cent. of a substance which is known under the name of terra alba, but which in reality is only disguised plaster of Paris. Another sample, at 84*s.* per cwt., contained twenty-one per cent. of this terra alba. A third, called caraways, contained, some, twenty-eight, and others nineteen per cent. of terra alba; the purer article being 8*d.*, and the other 5*d.* per pound.

The use of this terra alba is, in addition to its being a gross fraud, also very injurious; and when we remember that children are the chief consumers of these comfits, it is impossible to calculate the evil that arises from having a quantity of rubbish thrown into their delicate stomachs.

The paints or tints with which the different images, the lozenges, and many of the "drops," are coloured are made from vegetable juices, earthy matter, or the oxides of metals, such as lead, copper, arsenic, and iron.

In Accum's treatise on the Adulterations of Food we find it stated that, in the preparation of sugar-plums, comfits, and other kinds of confectionary, especially those sweetmeats of inferior quality frequently exposed for sale in the open streets, for the allurement of children, the grossest abuses are committed. The white comfits are chiefly composed of a mixture of sugar, starch, and Cornish clay; and the red drops are usually coloured with the inferior kind of vermilion. This pigment has generally been previously adulterated with red lead. Other kinds of sweetmeats are sometimes rendered poisonous by being coloured with preparations of copper.

There are few substances so subject to adulteration as lozenges; not only are materials added to them which are cheaper than the sugar in their composition, but others also of a very deleterious cha-

racter, as preparations of lead, arsenic, copper, etc., are employed for the purpose of colouring them.

The papers also in which some sweetmeats, such as those known as "kisses," are wrapped have also a great tendency to communicate a poisonous character, on account of the colour with which they have been stained, being usually made from the salts of arsenic, copper, lead, etc.

Dr. O'Shaughnessy purchased various lozenges and articles of confectionary, both coloured and colourless, and wrapped in stained papers. He purchased three samples at different shops. Of the coloured articles, the greater number were sold expressly for eating. Out of seven coloured yellow, six contained deleterious substances, such as chromate of lead, antimony, and gamboge. In the greens he very often found copper and lime. Some of the reds contained chromate of lead and red lead.*

"I may mention," says Mr. Mitchell, "that a friend brought me, some little time since, a piece of sugar 'rock' (such as is sometimes found in cakes), from a highly respectable confectioner, and on examination it was found that the colour was due to the presence of verdigris (acetate of copper), which is an exceedingly poisonous salt."

Every investigation that has been made into the colouring matters used by confectioners for the adornment of their sweetmeats has invariably ended in the discovery of poisons of the most destructive and deadly nature.

We must remember that these sweetmeats are principally purchased by children, whose organization is the more susceptible of their influence. The usual defence of this iniquitous custom is, that the mineral poison is used in extremely small proportions. But this would only serve to prolong the agony of the child; for it will, nevertheless, most certainly produce disease, and, if persevered in, even-

* See second volume of the *Lancet*, 1830-1831.

tually death. The only choice rests therefore between sudden and lingering death. The preparations of lead, copper, and arsenic are what is called by medical men cumulative poison, or poisons which are, little by little, taken up by the system, until their full effects become manifested.

In France, all vendors of sweetmeats are held responsible for all accidents occasioned by the confectionary sold at their shops. The use of injurious colouring ingredients is stringently prohibited by law.

In Switzerland and Belgium these restrictive laws are also in force. But in England—the centre of civilization, as we are so fond of calling it—poison is openly vended in the streets, shop-windows are filled with it; and although Dr. Letheby tells us that "within the last three years no less than seventy cases of poisoning have been traced to this source," still no steps are taken to decrease or prévent the evil.

The scientific and searching inquiry made by Dr. Hassall into the character of the colours used by the London confectioners has brought to light the full horrors of the horrible practice. He purchased his samples at shops in every part of London. He bought every kind of sweetmeat lozenges, comfits, burnt and sugared almonds, kiss-me-nows, clove and peppermint sticks, and sugar imitations of bacon, fish, fruit, vegetables, and animals. Altogether he collected one hundred and one different kinds of confectionary.

In colouring them, one hundred and forty poisonous colours had been employed, as many as seven colours being sometimes used for painting the same sweetmeat. Chromate of lead occurred in fifty-nine, red lead in twelve, and white lead in four instances.

The salts of lead are extremely poisonous, and although not what are called active poisons, unless taken in large doses, still they possess a very virulent action.

The treatment in cases of poisoning by lead taken in a considerable quantity is as follows:—Administer

speedily some alkaline sulphate (such as Epsom salts—the sulphate of magnesia). If the patient does not vomit, give an emetic of the sulphate of zinc. Do this even before the arrival of a medical man, for in such cases delays are most dangerous.

Brunswick green is frequently employed for colouring sweetmeats. This substance is known as the oxychloride of copper. A small quantity of it is sufficient to produce death. A case is mentioned by Henke where a boy, aged three, died from sucking a cake of green water-colour prepared with this mineral poison, such as is sold in the colour boxes of children. The most easily obtainable antidote is the white of eggs.

Emerald green is also commonly used in the paint with which sugar compounds are ornamented. This substance is familiar to chemists under the title of Scheele's emerald green, and is an arsenite of copper. It is one of the most active of the copper poisons, but its effects are rather due to the arsenic than the accompanying metal. Professor Taylor, speaking of it, says, "The dangerous practice of using this powerful poison, to give a colour to confectionary, is very prevalent, and accidents often arise from this cause. An instance has been communicated to me, in which three lives were nearly sacrificed at a school near Manchester, owing to the boys having eaten some ornamental confectionary, which owed its green colour to arsenite of copper.

Treatment.—Generally there is vomiting, for the salts of copper act powerfully as emetics. The efforts of the stomach should be aided by copious draughts of warm water or milk. The white of eggs is also recommended by chemists, because it is known to form an insoluble compound with oxide of copper; but Professor Taylor asserts that recovery is mostly due to the vomiting, "not to the effect of any supposed antidote."

How urgently do such rank abuses as these call for immediate and stringent reform. Surely, there should

be some one empowered to interfere between the health and lives of the people and the tricks of trade.

In all cases where children are seized with sickness after partaking of sweetmeats, the first thing to be done is to discover, if possible, the colour of the article. The corners of the mouth, the fingers, or the tongue usually retain traces of the colouring matter. The treatment to be then used should be such as we have here given, and it should be immediately followed, even before the arrival of the medical man, who, in all cases, should be instantly sent for.

The more strongly to impress upon our readers the danger of allowing children to eat these terrible compounds, we will mention one or two of the cases recorded of poisoning from the use of coloured confectionary.

In September, 1847, three adults and eight children were taken to Marylebone Workhouse, having been seized with vomiting and retching after eating some coloured confectionary. Only twopenny worth had been purchased, and eleven persons had shared it, yet the symptoms appeared within ten minutes of its being taken. The poisonous colours had been made from verdigris.

Dr. Guy mentions a case where a green ornamental basket used at an evening party was distributed among the guests. Severe vomiting and purging was the result.

At Nottingham, twenty persons were poisoned at a public dinner through partaking of a blanc-mange, the top of which was coloured with arsenite of copper (emerald green). One of them lost his life.

Another case is mentioned by Dr. Letheby. In May, 1850, two little girls were taken to the London Hospital, suffering from the effects of poison. They had bought some sugar ornaments and coloured confectionary from a Jew in Petticoat Lane, and soon after eating them, they were seized with vomiting pains in the stomach, and burning of the mouth. On analysing

the vomited matters, there was abundant evidence of the presence of arsenic, copper, lead, iron, all of which metals had been derived from the confectionary of which the children had partaken.

On making inquiry, Dr. Letheby was informed that between thirty and forty children had been attacked in a similar way, after purchasing sweetmeats from the Jew in question, who was not acquainted with the poisonous nature of his merchandise; for he had purchased it, so he stated, as the refuse stock of a large and "very respectable" firm in the city.

LIQUIDS.

NATURAL DRINKS.

MILK.

MILK is an opaque, white, emulsive fluid, secreted by the females of the class *mammalia* for the nourishment of their young. That to which we shall confine our remarks is the milk of the cow.

"Milk," says Professor Johnston, "partakes of the nature both of vegetable and animal food. It contains a large proportion of curd and butter, which represent the fibres and fat of beef, and, at the same time, a large proportion of sugar, which represents the starch of wheaten bread."

Subjected to a microscopical examination, it is found to contain myriads of excessively small globular particles floating in a serous liquid. These particles are butter, and being specifically lighter than the liquor in which they are suspended, they quickly separate on standing, and rise to the surface, carrying with them some caseine, and retaining some of the serum, thus forming cream. The milk from which the cream is separated is termed skim-milk. By agitating cream, as in the process called churning, the fatty globules unite and become butter; the residue, called buttermilk, consists of caseine, serum, whey, and a little butter.

Milk has been repeatedly analysed by our best chemists, but as its constituent parts vary according to

the food, the age, and the health of the cow, of course no decided results can be obtained. After a course of the most elaborate experiments, MM. O. Henri and Chevalier give the following as the average composition of cows' milk :—

Caseine.	Butter.	Sugar of Milk.	Various Salts.	Water.
4·48	3·13	4·77	0·60	87·02

So that in 100 parts of milk there are 12·98 of solid substances.

The relative quantity of cream which milk affords is determined by a glass tube divided into 100 parts. This instrument is called a lactometer, and by the thickness of the layer of cream which in a few hours forms at the top of the milk, so do you judge of its quality. Dr. Pereira says that he repeatedly examined by the lactometer the milk supplied to him by a respectable dealer in the metropolis, but that the results were very unsatisfactory, as the quantity of cream which he procured varied from five to twenty-three per cent. by measure.

The morbid changes produced in the quality of the milk by diseased conditions of the cows have long attracted attention. They were observed first of all in Paris, and consisted in want of homogeneousness, imperfect liquidity, and the presentation, when examined by the microscope, of certain mucous globules not found in healthy milk. Labillardière states that the milk of a cow affected with a disease of the lungs contained seven times more phosphate of lime than usual; and Dupuy also speaks of the large quantity of calcareous matter in the milk of cows, in whose lungs abundant deposits of the same substance were found.

In London, cows are almost invariably kept shut up in sheds, the dimensions of which are various, but which are always insufficiently ventilated. Their food consists for the most part of grains and distillers' wash, which have the effect of increasing the secretions of milk to an unnatural extent, and also of ren-

dering the animals diseased. It has been clearly ascertained that if cows are fed upon grains their constitutions become quickly destroyed; but such is their fondness for them, and, above all, for distillers' wash (the refuse slops of distillers), that after having been fed upon it for a week or more, their appetites become so depraved that they will take no other food. "The result of feeding cows upon this diet," says a New York paper, "is, their milk-producing organs are stimulated to a wonderful degree; they yield enormously, but soon become diseased; their gums ulcerate, their teeth drop out, and their breath becomes fœtid. Though thus diseased, they do not fall away in flesh, but, on the contrary, puff up and bloat to an appearance of great fatness; their joints become stiff, so that they cannot with ease lie down, and rarely or never come out from their sheds alive."

The Honourable F. Byng, in a pamphlet on the Sanitary Condition of the Parish of St. James's, Westminster, gives the following description of the state in which he found the cow-sheds of the district. "Two of these sheds (of which there are fourteen in the parish) are situate at the angle of Hopkins and New Street, Golden Square, and range one above the other, within a yard of the back of the houses in New Street. Forty cows are kept in them, two in each seven feet of space. There is no ventilation save by the unceiled tile roof, through which the ammoniacal vapours escape into the houses, to the destruction of the health of the inmates.

"Besides the animals, there is at one end of the sheds a large tank for grains, a store place for turnips and hay, and between them a receptacle into which the liquid manure drains, and the solid is heaped. At the other end is a capacious vault with a brick partition, one division of which contains mangel-wurzel, potatoes, and turnips, and the other a dirty, yellow, sour-smelling liquid called brewers' wash, a portion of which is pumped up and mixed with the food of the cows. The

neighbours are subject also to the annoyance of manure carts, which frequently stand some time in front of their houses; and when the mouth of the vault is opened to admit the ingress of the brewers' wash, a burning sour smell is described by them as pervading the dwellings.

"After the buildings have remained closed for the night, the atmosphere within becomes heated, foul, and unwholesome. In summer-time, the smell is most offensive. Decomposition of the vegetable matters in the vault is also stated to be frequent, and the stench thence arising insufferable.

"At the opposite side of the houses, in the same street, is another shed, with even less possibility of ventilation than in those just described. Thirty-two cows stand side by side, two in each space of seven feet, as above. In Marshall Street there is a third establishment, containing twenty-eight cows. In a wall on one side, overlooking a yard in which is a slaughter-house, are several grated openings, but they are carefully covered with pieces of sacking, as if to prevent all possible admission of air. In the shed are receptacles for vegetables and grains as before. The manure tank holds twelve tons, and that for brewers' wash 600 gallons. It is to be remarked, that even the manure, from the nature of the food supplied to the cows, acquires a peculiarly unhealthy and offensive odour, altogether dissimilar to that from farm-fed animals."

In this atmosphere, reeking with all these pestiferous effluvia, the poor creatures are kept close shut up night and day, till, their milk failing, they are consigned to the butcher. The effects of this system of feeding, impure air, and deprivation of all exercise, are thus described from actual inspection of four cows, which the keeper said were suffering from the old disease.

"There was inflammation of the mucous membrane of the mouth, fauces, and gullet, a catarrhal

discharge from the nostrils, and such prostration of the muscular system, as to render the animals unable to remain in a standing position for any length of time. The mucous membrane of the mouth is sometimes so blistered as to prevent the animals from taking food. Swellings of the udder appeared, attended by a change in the quality and deficiency in the secretion of milk. The feet also became much diseased and swollen; general emaciation followed, in which the animals continued for an indefinite period, or till death. Four month prior to this visit, the owner of one of these sheds lost thirteen cows by disease.

"A Dutch cow was pointed out, which was evidently in a state of marasmus, her head hanging nearly to the ground; the horns cold; the ribs staring through the hide on each side of her emaciated body, on which the hair bristled and stood erect. Notwithstanding this prostration of the vital powers, the cow was regularly milked with the others, furnishing a daily supply of ten quarts."

Dr. Normandy, in his evidence before the Parliamentary Committee, tells us that he witnessed, in Clerkenwell, a spectacle which prevented him from tasting milk for six months. He saw about thirty or forty cows in the most disgusting condition one can possibly imagine: full of ulcers; their teats in a most horribly diseased ulcerated state, and their legs full of tumours and abscesses; in fact, it was terrible to look at. A fellow was milking these poor cows in the middle of all this purulent abomination. The litter on which the beasts stood was a mass of fuming any fermenting matter, resembling a dungheap.

The animals kept by a great many London cowkeepers are in the same condition as that described by Dr. Normandy. There can be no doubt that diseased matter is thus introduced into the milk. The absurd notion that chalk is employed in adulterating milk, most probably owes its origin to the

large quantities of calcareous matter deposited from the milk taken from cows with diseased lungs. Labillardière, as we have before remarked, states that the milk of a cow affected with a kind of tubercular phthisis contained seven times more phosphate of lime than usual. That the milk is affected by the sanitary condition of the female yielding it is undeniably proved; as a child may be salivated by suckling a nurse under the influence of mercury, There can be no doubt therefore that the use of the diseased milk of cows must have an evil effect upon the systems of those drinking it.

While cows are kept in the state above described, their milk, instead of being the model-food, and containing all that is necessary for the support of the human being, is an absolute poison. The only way to remedy the evil is by the appointment of Government inspectors, empowered to enter the cow-sheds at any time, and visit the owners with severe fines, or, better still, with imprisonment, whenever they are found to be in an uncleanly or unhealthy condition. Of any such appointment there appears at present to be but little probability.

We have no hesitation in saying, that almost the only adulteration practised with milk is by the addition of water, so as to increase the volume and consequent profits. Milk will bear an enormous quantity of water without being much deteriorated in appearance. Even when it is added in the proportion of three to one, the compound will still have a strong resemblance to pure milk, although a practised eye will detect the blue tinge that always betrays the over-diluted mixture.

Perhaps the easier method of testing the purity of milk, is by evaporating a given weight of it, at a gentle heat, until it ceases to lose weight. Good milk should yield nearly thirteen per cent. of residue. Another method is by acidulating a known quantity of milk with vinegar or rennet, until it ceases to

coagulate. The curd which will be obtained is caseine. It should be separated from the fluid, and well squeezed, in order to give back every part of liquid which it contains, and then dried at a steam heat. If the milk has been pure, this caseine should, according to MM. O. Henri and Chevalier, weigh about four per cent. of the original quantity of milk experimented upon.

We have been told that it is a common practice with dairymen to dilute their milk with a large proportion of skim milk—i. e., milk from which the cream has been removed, and which, consequently, has lost so much nutritive power. The best method of detecting this fraud is, first, by the use of the lactometer, and afterwards by applying the test above described for ascertaining the quantity of caseine, which, in such a case, should be present to a very large amount.

It is absurd to imagine that chalk is ever employed for adulterating milk. From its insolubility and greater specific gravity it would subside at the bottom, in the form of a thick paste, and be easily detected. Another popular fallacy is that sheep's brains are used for thickening both cream and milk, but as yet no traces of them have been found on analysing these fluids. Occasionally, arrow-root jelly is mixed up with cream, to give a rich consistency. About an ounce of arrow-root, of the value of 1½*d.*, will make nearly three pints of a liquid as thick as cream.

The popular belief that brains of various animals, such as sheep, calves, or horses, are employed to adulterate and thicken milk that has been reduced by water, is, as we have before remarked, utterly without foundation. But there is something so revolting and sickening in the notion, that, to assure our readers on this point, we will state that, from the experiments which were performed at Paris by the *Conseil de Salubrité*, no such admixture could be detected in any of the considerable number of samples of milk which

were then submitted to examination. The results of the investigations made by the eminent chemists of the *Conseil* have proved that, were this disgustingly possible fraud ever practised, it would be immediately detected by the microscope.

We are informed by Dr. Normandy, that milk is sometimes kept in zinc pans, for the purpose of augmenting the yield of cream. It should be known that lactic acid, which is formed in that case, and which exists in the free state, even in new milk, might decompose a little of the carbonate, or saturate a little of the oxide of that metal, and render the milk unwholesome, and possibly poisonous. The presence of zinc is detected by coagulating the milk with nitric acid, filtering, super-saturating with ammonia, and filtering again, if necessary. If, on pouring hydro-sulphuret of ammonia in the clear filtrate, a white precipitate is found, it is sulphuret of zinc.

Perhaps one of the greatest evils arising out of the adulteration of milk is, that it is largely employed as an article of food for children and invalids. When pure, it contains all the elements necessary for the nutrition and growth of the body, so that it is, by itself, capable of supporting life. Out of the caseine or curd are formed the albumen and fibrine of the blood; the latter serves to fatten, and with the sugar aids in keeping up the animal heat, by yielding carbon and hydrogen to be burnt in the lungs. The various salts are necessary for the formation of bone, and giving colouring matter to the blood and hair.

When milk is mixed with farinaceous substances, such as arrow-root, sago, tapioca, bread, or rice, it constitutes what is called the milk diet of invalids. It is ordered, Dr. Pereira tells us, when medical men are desirous of affording support to the system with the least possible stimulus or excitement. It is well adapted for chest diseases or inflammation of the alimentary canal, or of the bladder, where, although the diet should be nutritious, still if it were too

stimulating, the worst consequences would result. It is also considered one of the best means of preventing or curing gout; and when children are suffering from, or have a tendency to, scrofula, it is recommended by medical men.

All these fsets tend to prove the great evils that result from the adulteration of milk. It deceives the medical man, who, in many cases, has to judge with the nicest accuracy the exact amount of bodily strength he should allow to his patient; and it is a deceit and fraud upon all who purchase it as an article of food, and are forced to trust to the honesty of the dairyman.

WATER.

Cavendish was the first philosopher who clearly proved that water was composed of hydrogen and oxygen. He demonstrated it by burning oxygen and hydrogen gases in a dry glass vessel, when a quantity of pure water was formed, exactly equal in weight to that of the gases which had disappeared. The celebrated French chemist Lavoisier was the first who succeeded in analysing water. He passed a known quantity of steam over iron heated to redness, in a glass tube. Hydrogen gas was given off, and the metal in the tube became oxidized—that is to say, united with the oxygen; and the weight of the hydrogen disengaged and the increased weight of the iron, from combining with oxygen, exactly corresponded with the quantity of water decomposed. It has therefore been thoroughly ascertained that water is the sole product of the combustion of hydrogen gas—the term *combustion*, in its common signification, implying the rapid union of oxygen gas and combustible matter, accompanied with heat and light.

The precise composition of water has been ascertained with great care by Berzelius and Dulong, who

state that it consists of hydrogen and oxygen, in the proportion of one of the former to eight of the latter. Hence nine pounds of water are composed of one pound of hydrogen and eight of oxygen.

Water forms, on the average, three-fourths of the weight of living animals and plants, and it has been calculated that it covers, at the least, three-fourths of the earth's surface. Human blood contains about eighty per cent., and the flesh seventy-four per cent. of water. Professor Quetelet describing a model man, gives as his weight 154 lbs., of which 116 lbs. consist of water and only thirty-eight of dry matter. However strange this assertion may seem, and however inconsistent the proportion of dry matter to the water may appear, it is nevertheless most undeniably true. Dr. Carpenter, the talented author of "Human Physiology," has shown how small a quantity of solid matter is sufficient to support life, by relating the case of a boy of ten years of age, who, through the ill usage of a stepmother, was starved until he only weighed twenty-five pounds. He appeared to consist of merely skin and bone. Supposing that the quantity of water in his body had been reduced from three-fourths to two-thirds, the solid matter would be about eight pounds.

In the vegetable kingdom, the turnip and the white cabbage contain the greatest amount of water (ninety-two per cent.) It is stated that mosses may be deprived of moisture, without having their vitality destroyed.

Water in its natural state is never perfectly pure, rain-water being contaminated by the impurities which it takes up in falling through the air, spring-water by those with which it meets in rising from the earth. The natural colour of water in large masses is blue, but it is only in certain parts of the Pacific and Mediterranean that the colour is observable. In our muddy English rivers we find it grey or brown; sometimes, when the amount of vegetable matter which it contains is very great, it appears almost black; and off the

British coast, the yellow matter which it holds in solution combines with the native blue, and gives it a green tint. The very clearest spring-waters, even after being filtered, are never pure.

Water is the only substance which, to be fit for consumption, must not be pure; that is to say, it must contain some atmospheric air. Pure water is, of course, a chemical compound, and contains no air whatever. But such water is unfit for consumption, because it contains no air; it is indigestible, heavy, and in fact it would appear that distilled water, which is pure water, and which is supplied to the navy occasionally, from stills erected for the purpose on board, is actually so vapid, that after a few days' use the sailors will hardly drink it. Neither is it prudent that such distilled water should be used, for, by reason of its containing no air, it has a great tendency to take air from the medium where it is kept; so that if distilled or boiled water, which contains no air, is kept in a ship's hold, or in an impure dwelling, it will absorb precisely the quantity of air which it can absorb, namely, five cubic inches per gallon, and become perfectly putrid and fœtid, or contaminated by organic matter.

Water should always be kept, when it has been distilled or boiled, in perfectly ventilated rooms or pure receptacles, or else it will become as foul as or more foul than before.

Dr. Stenhouse, three or four years ago, found that charcoal had the power of purifying air. Acting upon his data, Dr. Normandy has since found that charcoal has the same power of purifying *aërated* water which contains foul organic matter, provided only the water is aërated; that is to say, contains air.

Hence it is, that if the water companies were to pass the water through large filters containing charcoal, the water so obtained would be rendered perfectly sweet. "My own experience," says Dr. Normandy, "has taught me, in reference to my apparatus for the distillation of sea-water, that two

cubic feet of charcoal are sufficient to purify perfectly 500 gallons of aërated water per day; and the value of this suggestion which I beg to make is increased, I think, by the fact that the charcoal does not require renewing; that is to say, when once the filter is made, it will last for ever, because it disinfects the water as it does the air, not by mechanical separation, but by actual destruction."

The finest natural water known is said by Professor Johnston to be that of the Loka, in the north of Sweden, which flows over hard granite, upon which water makes scarcely any impression, so that particles of the granite are not found in suspension to any very great extent. The water of the Loka contains only one-twentieth of a grain of solid mineral matter in each imperial gallon.

Some of the waters of Surrey contain no more than four or five grains in the gallon, but that of the Thames, in the vicinity of London, contains as much as twenty-one grains per gallon; and from twenty to thirty grains per gallon may be taken as the average amount of solid matter found in waters usually employed for domestic purposes.

A more terrible account of the impurities of Thames water was, however, given by Dr. Thomson, when examined before the Adulteration of Food Committee. He stated that he analysed several samples of water, all of which were obtained under similar circumstances; that is to say, at the same hour of the day, a short time before high water. The total quantity of impurity at high water at Vauxhall, comprehending mechanical matter, organic matter in solution, and inorganic matter in solution, was 102·42 grains per gallon. At Hungerford, the total quantity of the same ingredients was 115 68 grains per gallon; and at the Surrey end of London Bridge, the same ingredients amounted to 113·24 grains, so that there was slightly less impurity at London Bridge on the Surrey side than there was at Hungerford.

The water supplied by the New River Company contains nineteen and a half grains in the gallon, while that supplied by the Hampstead Company contains from thirty-five and a half to forty.

In towns, and generally in the neighbourhood of dwellings and farm-yards, the water of wells is not only impure, but frequently unfit to drink. The rains falling upon impure matter carry it through the soil to the wells, and thus nervous and even fatal diseases are frequently produced among those inhabitants of towns who make the local well-water their habitual drink.

In the neighbourhood of grave-yards the impurities contained in well-water are exceedingly great; and Mr. Noad, who lately analysed the water drawn from a well close to the churchyard on Hampstead Hill, found it to contain upwards of one hundred grains of solid matter in the imperial gallon, more than half of which consisted of nitrate of lime and magnesia. The presence of these nitrates (i. e. nitric acid, combined with lime, magnesia, etc.) is ascribed to the decomposition of animal matter in the neighbouring burial-place.

As water serves the most important purposes in the animal economy, it is essential that it should be, as far as possible, pure. It not only repairs the loss of the aqueous part of the blood caused by evaporation and exhalation, but also aids in the digestion of food. Dr. Pereira, Count Rumford, and other eminent authorities, are moreover inclined to look upon it as affording absolute nutriment, and assisting in the formation of the solid parts of the body. In any case, attention to the quality of the water employed as a drink is most important. Natural waters are generally divided into three classes, viz.: 1, common waters, or those usually employed as drink and for cooking food; 2, sea water; 3, mineral waters, or those which possess some peculiar properties from the mineral substances which they contain.

Under the head of common waters, with which alone we propose to deal, rain, spring, well, and river waters are included. Of these, rain-water is the purest, the rain-water which falls in the country being much purer than that which falls in towns. The rain-water of towns is, however, much purer at the end than at the commencement of a shower. The first rain which falls is generally found to contain sooty substances, besides indications of sulphates, chlorides, and calcareous matter.

Whenever rain-water is collected near large towns, it should be filtered and even boiled before being used; for, as it contains less saline matter than other waters, it is more easily impregnated with lead from the roofs of houses, water-pipes, cisterns, etc. Snow-water, we may observe, contains no air, and instead of quenching thirst, augments it. "The natives of the Arctic regions," says Captain Ross, "prefer enduring the utmost extremity of this feeling rather than attempt to remove it by eating snow." When melted, however, snow has the same general properties as other kinds of water.

Spring-water is in fact only rain water, which, after running through a certain portion of earth, reappears at the surface of some declivity. In its passage it generally takes up some soluble matter, the nature of which, of course, varies with that of the soil. Its constituents are similar to those of well-water, the name given to water which is obtained by sinking wells, or pump-water, as it is usually called, from its being frequently raised by means of pumps. In this water the earthy salts (especially the bicarbonate and sulphate of lime) are found in large quantities. It usually decomposes and curdles soap, and is then styled *hard water*, to distinguish it from river and other waters which mix readily with soap, and are termed *soft waters*.

Hard water does not dissolve organic matter so readily as soft water; so that in tea-making and brewing the latter is always used in preference to

the former. Hard water is also an improper drink for persons suffering from dyspepsia. Its effect on horses is peculiar, and is thus alluded to by Mr. Youatt (Youatt on the Horse):—"Hard water drawn from the well will assuredly make the coat of a horse unaccustomed to it stare, and it will not unfrequently gripe and otherwise injure him. Instinct or experience has made even the horse himself conscious of this, for he will leave the most transparent and pure water of the well for a river, although the water may be turbid, and even for the muddiest pool."

Mr. Chadwick, in his *Report to Her Majesty's Principal Secretary of State for the Home Department, on an Inquiry into the Sanitary Condition of the Labouring Classes* (1842), observes that "water containing animal matter, which is the most feared, appears to be less frequently injurious than that which is the clearest, viz. spring-water; from the latter being oftener impregnated with mineral substances." But although the purest waters are in themselves the most wholesome, very pure water possesses the dangerous quality of rapidly corroding lead, and thereby becoming contaminated. The neutral salts usually found in spring-water prevent the corrosive action of water and air; but rain and other pure kinds of water, which contain but a very small portion of these protecting salts, readily acquire an impregnation of lead from roofs, cisterns, etc.

River-water is a mixture of rain and spring water, and when deprived of the matters which it frequently holds in suspension, its purity is usually considerable. Thames water, between Brentford and Chelsea, contains, on the average, in each gallon about sixteen and a half grains of carbonate of lime, and two and a half grains of sulphate of lime and chloride of sodium combined, besides minute portions of oxide of iron, silica, magnesia, and carbonaceous matter. The carbonate of lime is held in solution by carbonic acid, thus forming bicarbonate of lime. By boiling, the

acid is driven off, and a precipitate of carbonate of lime is formed on the sides of the vessel, which constitutes what is called the *fur* of the tea-kettle, and the *crust* of the boiler.

Organic matter in a state of decomposition is found in every river-water, in greater or less proportion. Generally the quantity present is insufficient to produce injurious effects; but when it is present in large quantities, the water containing it is, of course, very deleterious. In those cases in which its operation has been unequivocally recognised, Dr. Pereira tells us (Treatise on Food and Diet) that it has manifested itself by the production of dysentery; and that at the Nottingham assizes, in July, 1836, it was proved at a trial, on which he was a witness, that dysentery, in an aggravated form, was caused in cattle by the use of water contaminated with putrescent vegetable matter, produced by the refuse of a starch manufactory. The fish and frogs in the pond through which the brook ran were destroyed. All the animals which drank of this water became seriously ill, and in eight years the plaintiff lost twenty-four cows and nine calves, and all by dysentery, accompanied by nearly the same symptoms. It was also shown that the animals sometimes refused to drink the water; that the mortality was in proportion to the quantity of starch made at different times; and that subsequently, when the putrescent matter was not allowed to pass into the brook, but was conveyed to a river at some distance, the fish and frogs began to return, and the mortality ceased among the cattle.

The symptoms of illness in the cows were as follows:—The animals at first got thin; had a rough, staring coat; and gave less milk (from two to three quarts less) every day; they then became purged, passed blood with the *fæces*, and at length died emaciated and exhausted. On a *post-mortem* examination, the intestinal canal, throughout its whole length, was found inflamed and ulcerated. The water which was examined

was loaded with putrescent matter, and contained chloride of calcium (derived from the chloride of lime employed in bleaching the starch). Traces of free sulphuric acid were occasionally found by one witness.

It appears, too, from Dr. Cheyne's report on Dysentery, in the "Dublin Hospital Report" (vol. iii. p. 11), that the soldiers who occupied the old barracks at Cork were frequently attacked with dysentery. At the period in question the troops were supplied with water from the river Lee, which, in passing through the city, is rendered unfit for drinking by the influx of the contents of the sewers from the houses, and which is also brackish, from the ascending tide. Mr. Bell, suspecting the water might have caused the dysentery, upon assuming the care of the sick, had a number of carts engaged to bring water for the soldiers, from a spring called the Lady's Well, while at the same time they were not permitted to drink the water from the river. From this simple arrangement the dysentery very shortly disappeared from among the troops.

The influence of water containing decomposing organic matter is shown in a milder form by slight relaxation of the bowels. "The beneficial effects derived from care as to the quality of water," says Mr. Chadwick, "is now proved in the navy, where fatal dysentery formerly prevailed to an immense extent, in consequence of the impure and putrid state of the supplies, and care is now generally exercised on the subject by the medical officers of the army."

"The decomposing organic matter which is found in water consists principally," says Dr. Pereira, "of the exuviæ of animal and vegetable substances. The water of some of the wells of the metropolis are occasionally contaminated with the odour and flavour of gas tar. I have myself found this to be the case in a specimen of well-water obtained near the London Hospital."

It appears from the "Report on the Health of Towns"

(effect of interment of bodies), dated 14th June, 1842, that the pump-water obtained from the vicinity of London churchyards was found to be more unfit for use than even that which is obtained from the well on Hampstead Hill, to the impurity of which we have already called attention.

Dr. Copland, in his evidence before the committee of the House of Commons, states that water which percolates through soil abounding in animal matter becomes injurious to the health of the individuals using it. "The digestive operations," he says, "are affected by water abounding with putrid animal matter; so that burying in large towns affects the health of individuals—in the first place by emanations into the atmosphere, and, in the second place, by poisoning the water percolating through the soil."

Living beings (animal and vegetable) constitute another class of impurities in river-water, although it must be understood that the aquatic monsters usually exhibited in London, by means of the solar and oxyhydrogen microscopes, are usually collected in stagnant pools in the neighbourhood of the metropolis, and are not found in the water usually supplied for domestic purposes.

To sum up, then, rain-water which falls in country districts is the purest, river-water ranks next in purity, and after these the common spring-water. Rain-water is more liable than any other to become impregnated with lead; river-water contains the largest amount of decomposing organic matter; and spring-water is peculiarly unfitted for dyspeptic patients, on account of the large amount of mineral matter which it holds in solution.

The effects of drinking water impregnated with lead are most fatal. First of all, *lead*, or *painter's colic* makes its appearance, which is accompanied, as in all cases of poisoning by lead, by a narrow leaden blue line on the edge of the gums attached to the necks of two or more teeth of either jaw. If the

cause of the illness be not detected, and the water not discontinued, palsy usually succeeds colic.

The following remarks on the employment of leaden pipes for conducting water are important, and we accordingly give them at length. They are derived from a paper by Dr. Christison (Transactions of the Royal Society of Edinburgh, vol. xv.) :—

"1 Lead pipes ought not to be used for the purpose, at least when the distance is considerable, without a careful examination of the water to be transmitted.

"2. The risk of a dangerous impregnation with lead is greatest in the instance of the purest waters.

"3. Water which tarnishes polished lead, when left at rest upon it in a glass vessel for a few hours, cannot be safely transmitted through lead pipes, without certain precautions. It is probable, though not yet proved, that if polished lead remain untarnished, or nearly so, for twenty-four hours in a glass of water, the water may be safely conducted through lead pipes.

"4. Water which contains less than about an eight-thousandth part of salt in solution, cannot be safely conducted in lead pipes, without certain precautions.

"5. Even this proportion will prove insufficient to prevent corrosion, unless a considerable part of the saline matter consist of carbonate and sulphate, especially the former.

"6. So large a proportion as a four-thousandth, probably even a considerably larger proportion, will be insufficient, if the salts in solution be in a great measure muriates.

"7. It is right to add that in all cases, even though the composition of the water seem to bring it within the conditions of safety now stated, an attentive examination should be made of the water after it has been running for a few days through the pipe. For it is not improbable that other circumstances besides

those hitherto ascertained may regulate the preventive influence of the neutral salts.

"8. When the water is judged to be of a kind which is likely to attack lead pipes, or when it actually flows through them impregnated with lead, a remedy may be found either in leaving the pipes full of the water, and at rest for three or four months, or by substituting for the water a weak solution of phosphate of soda, in the proportion of about a twenty-five-thousandth part." The object of this is to form, while the water is at rest, a fine film of mixed carbonate and phosphate of lead, which shall adhere so firmly as not to be swept away, when the water is allowed to flow, and which will serve as a lining to prevent the contact of the running water with the metal.

The following are the tests, as given by Dr. Pereira, by which the presence of the ordinary impurities found in common waters of all kinds may be ascertained:—

"1. Ebullition. By boiling, air and carbonic acid gas are expelled, while carbonate of lime, which has been held in solution by the carbonic acid, is deposited. The latter constitutes the fur or crust which lines tea-kettles and boilers.

"Proto-sulphate of iron. If a crystal of this salt be introduced into a phial filled with the water to be examined, and the phial be well corked, a yellowish-brown precipitate (sesqui-oxide of iron) will be deposited in a few days, if oxygen gas be contained in the water.

"3. Litmus. Infusion of litmus or syrup of violets is reddened by a free acid.

"4. Lime-water. This is a test for carbonic acid, with which it causes a white precipitate (carbonate of lime), if employed before the water is boiled.

"5. Chloride of barium. A solution of this salt usually yields, with well-water, a white precipitate insoluble in nitric acid. This indicates the presence

of sulphuric acid (which in common water is combined with lime).

"6. Oxalate of ammonia. If this salt yield a white precipitate, it indicates the presence of lime (carbonate and sulphate).

"7. Nitrate of silver. If this occasion a precipitate insoluble in nitric acid, the presence of chlorine may be inferred.

"8. Phosphate of soda. If the lime contained in common water be removed by ebullition and oxalic acid, and to the strained and transparent water ammonia and phosphate of soda be added, any magnesia present will, in the course of a few hours, be precipitated, in the form of the white ammoniacal phosphate of magnesia.

"9. Tincture of galls. This is used as a test for iron, with solution of which it forms an inky liquor (tannate and gallate of iron). If the test produce this effect in the water before and not after boiling, the iron is in a state of carbonate; if after, as well as before, in that of sulphate. *Tea* may be substituted for galls, to which its effects and indications are similar. *Ferrocyanide of potassium* yields, with solutions of the sesquisalts of iron, a blue precipitate, and with the protosalts a white precipitate, which becomes blue by exposure to the air.

"10. Hydro-sulphuric acid (*sulphuretted hydrogen*). This yields a dark (brown or black) precipitate (a metallic sulphuret) with water containing iron or lead in solution.

"11. Evaporation and ignition. If the water be evaporated to dryness, and ignited in a glass tube, the presence of organic matter may be inferred by the odour and smoke evolved, as well as by the charring. Another mode of detecting organic matter is by adding nitrate (or acetate) of lead to the suspected water, and collecting and igniting the precipitate, when globules of metallic lead are obtained, if organic matter be present. The putrefaction of water

is another proof of the presence of this matter. Nitrate of silver has before been mentioned as a test."

In the purification of water, living beings and such substances as are held in suspension may be separated from it by the process of filtration. Water cannot, however, by means of any filter be deprived of substances held in solution. In order to destroy the vitality of animals and vegetables, to cause the expulsion of air and carbonic acid, and the precipitation of carbonate of lime, boiling should be had recourse to, after which the water may be passed through a filter with advantage.

Water may be effectually purified by distillation, although distilled water usually contains traces of organic matter. The water of the Seine, at Paris, can be clarified by the introduction of a piece of alum; and in England, also, alum is often used by those to whom the use of the filter is unknown, for cleansing muddy water. A very few grains of alum are enough to purify more than a quart of water; but although it certainly clarifies the water, it adds nothing to its chemical purity, but, on the contrary, increases its hardness.

Professor Clark, of Aberdeen, took out a patent for the purification of waters, in 1841. The process patented was described as "a new process for purifying the waters supplied to the metropolis by the existing water companies; rendering each water much softer, preventing a fur on boilers, separating vegetating and colouring matter, destroying numerous water insects, and withdrawing from solution large quantities of solid matter not separable by mere filtration." The process consisted in the addition of lime to the water. The lime combined with the excess of carbonic acid in the water, and formed carbonate of lime (chalk), which precipitated along with the carbonate of lime held previously in solution in the water. The effect of the process was the same as that of ebullition, but it had no effect on the gypsum of common water, and therefore could have little or no influence in rendering hard

water soft. The addition of alkaline carbonates (carbonate of soda, carbonate of potash, etc.) softens water, decomposes the earthy salts, and precipitates the earthy matters.

"The waters at present in use in the metropolis," says Dr. Hassall, "are all hard, and have all the disadvantages of hard water; they are, moreover, river-water, and for the most part contaminated to a great extent with organic matter, dead and living; add to these points the fact of their further deterioration by contact with lead in cisterns, and by the accumulation and growth of animal and vegetable productions which take place in those receptacles, and the case is proved against the whole of the present supplies of the metropolis.

MANUFACTURED AND NON-INTOXICATING DRINKS.

Chicory.

The dark brown powder which is commonly sold as chicory, is produced from the washed and ground root of the wild endive, or succory, a plant which grows wild in England and most European countries. It may be commonly met with in lanes and hedgerows, and is easily recognised, from the peculiarity of its foliage, and its large blue flowers.

In its natural state the stem rises from one to three feet high, but when cultivated, it shoots to the height of five or six feet. The root, which is shaped something like a parsnip, sinks deep into the ground, is white and fleshy-looking, and yields a milky bitter juice.

When this root has to be reduced to powder, it is taken up, washed, and cut into slices, which are put into heated iron cylinders, and roasted like coffee, by keeping up a revolving action, after which it is ground in mills.

The powder has a striking resemblance to dark ground coffee, and possesses a strong odour of liquorice. In France and some parts of the Netherlands, this plant is extensively cultivated for the sake of its root; but by far the largest amount of chicory is manufactured in Germany, where it is not only used for the adulteration of coffee, but the decoction from it is much liked by the poorer classes, who drink it at their meals, as we do tea.

In Guernsey, the endive is so extensively cultivated and manufactured into chicory, that the island has been wittily called the British Mocha. The quantity of chicory annually imported into England amounts to about five millions of pounds, and this is independent of the vast amount manufactured in this country, for in the counties of York, Bedford, and Surrey there are large endive plantations. As there is no other known use to which chicory can be applied, except as a means of adulterating coffee, this will convey some notion of the extent to which this shameful practice is carried. The chief advantage derived from mixing chicory with coffee seems to be that it rapidly imparts a deep colour to the water, and also gives a bitter taste, so that the decoction has all the appearance of being strong, although it contains but a very small amount of the more expensive substance.

Dr. Pereira says that the infusion of chicory "forms a perfectly wholesome beverage." The medicinal properties of the uncooked root closely resemble those of the dandelion; indeed, the endive and the dandelion belong to the same natural family of plants. "Its obvious effects," writes Dr. Pereira, in his *Materia Medica*, "are those of a stomatic and tonic. In large doses it acts as a mild aperient. Its diuretic operation is less obvious and constant. Its various chronic diseases, its continued use is attended with alterative and resolvent effects; but where the digestive organs are weak and readily disordered, it is apt to occasion dyspepsia, flatulency, pain, and diarrhœa." Of course these remarks apply to the unroasted root, but Dr.

Hassall, in order to discover what the effect of chicory itself produced upon the human frame, tried the following experiments. He gave an infusion of chicory to three persons, substituting it for tea at the breakfast meal. Some time after drinking it, each individual experienced drowsiness, weight at the stomach, and want of energy. Two other persons partook, for a considerable time, of the coffee bought at a shop where adulteration with chicory was largely practised. During the whole of this time they suffered more or less from diarrhœa.

It is not true, as has been alleged, that chicory enables coffee to be kept better and for a longer time than when in a pure state. This is simply a tradesman's excuse for the adulteration.

When coffee is largely adulterated with chicory, it is easy even by the touch to detect it, by merely taking a pinch of the compound and rolling it between the fingers. It adheres and forms a pellet, which pure coffee, being of a drier nature, will not do. Coffee will not agglutinate; chicory, on the contrary, has a great affinity for water, and will knead into a clammy mass. On the addition of a little moisture, coffee, adulterated with chicory, may be rolled into a hard pellet, which will drop like a small shot. It was this peculiar property of chicory to agglutinate, that suggested the idea of its being pressed, by the aid of machinery, into forms resembling coffee-berries. (See *Coffee*.)

In passing through the drug-grinder's hands, chicory is extensively adulterated. One of these grinders told Dr. Pereira that roasted peas and beans, damaged corn, and coffee husks, were used as sophistications, and that Venetian red or bole Armenian was employed as a colouring agent.

Dr. Normandy found that chicory was extensively adulterated with a kind of earthy matter, brick-dust or ochre, and sometimes even with charcoal, of which he had discovered as large a quantity as fifteen per cent.

It has been proved by analyses that chicory is

almost always sold in an adulterated form, the adulterations severally consisting of either damaged corn that has been washed, or sawdust. Mangel-wurzel has been detected. The colouring matter is invariably Venetian red or bole Armenian. So that on looking back at this long ramification of fraud, we first of all see the drug-grinder adulterating his bole Armenian and Venetian red with brick-dust; we next find this colouring matter mixed up with sawdust, and added to chicory, and, finally, we discover the grocer enriching himself by adding this so-called chicory to his coffee.

Cocoa and Chocolate.

It is computed that cocoa is used as an article of diet by at least fifty millions of the human race. Its chief consumption takes place in Spain, Italy, France, Central America and Mexico. It is an extremely nutritious substance, closely resembling milk in its composition. Thus milk when dried by evaporation, and the cocoa-bean when dried, consist respectively of—

	Milk.	Cocoa-bean.
Casein or gluten	35	21
Fat	24	51
Starch or sugar, etc.	37	22
Ash or mineral matter	4	4
Theobromine	2	2
	100	100

Therefore cocoa contains all the important nutritious principles which render an article of foody aluable.

Dr. Ure, in his "Dictionary of Arts, Manufactures, and Sciences," tells us that chocolate has for centuries been used in Mexico as an article of food. It is prepared from the seed of the Theobroma Cacao, a beautiful tree of small growth, with glossy dark leaves, which is a native of the West Indies and of conti-

nental America. It grows wild in Mexico and in the forests of Demerara. The Spaniards were the first to introduce chocolate into Europe, in the year 1526, and for a long time they kept the process of its manufacture a secret from the rest of the world. Linnæus was so fond of it, that he gave the specific name of *theobroma* (food of the gods) to the cocoa-tree, which produces it. The cocoa-beans lie in the fruit, which is somewhat like a cucumber, about five inches long and three inches and a half thick, and contains from twenty to thirty beans, arranged in five regular rows, with partitions between, and which are surrounded with a rose-coloured spongy substance, like that of water melons. Some fruit are so large as to contain from forty to fifty beans. Those grown in the West India Islands, Berbice, and Demerara are much smaller, and have only from six to fifteen, their development being less perfect than in South America. After the maturation of the fruit, when their green colour has changed to a dark yellow, they are plucked, opened, their beans cleared of the marrowy substance, and spread out to dry in the air. Like almonds, they are covered with a thin skin or husk.

A fatty substance, called butter of cocoa, is obtained by pressure from this bean. It is of the consistence of tallow, white, of a mild, agreeable taste, and not apt to turn rancid by keeping. From five to six ounces of butter may be obtained from a pound of cocoa. It has a reddish tinge when first expressed, but becomes white by boiling with water.

The bean of the cocoa is manufactured for the market in three different ways. The bean, after being roasted, is beat into a paste in a hot mortar, or is ground between heavy, heated rollers. This paste, mixed with starch, sugar, and other ingredients, in various proportions, form the granulated, flake, rock, and soluble cocoas of the shops. Or the beans are deprived of their husks, which are crushed, into

fragments, and form the well-known cocoa-nibs—the purest state in which cocoa can be obtained from the grocer. Or, lastly, the shelled bean is ground into a paste by means of hot rollers, and is then mixed with sugar and flavoured with vanilla. This forms the chocolate of commerce, an extremely nutritious article of diet, containing in a small compass much strength-sustaining capability.

The husk of the cocoa-bean not being used in the manufacture of chocolate, accumulates in large quantities in the manufactories of that article, and is imported into this country from the Italian and Spanish ports, under the name of "miserable." It is much consumed by the poorer classes in Ireland, and also ground up and mixed for adulterating the pure produce of the bean.

Mr. Mitchell, writing of the adulterations of cocoa, says, "Chocolate is adulterated with flour, potato starch, and sugar, together with cocoa-nut oil, lard, or even tallow." But it is a question whether the admixture of flour, starch, and sugar (in moderate quantities) can be looked upon as an adulteration. Professor Johnston writes, "The large proportion of oil it (the bean) contains justifies, as fitting it better for our stomachs, the practice of mixing or grinding up the cocoa with sugar, flour, or starch, in the preparation of cocoa paste or chocolate." Of course, the addition of more fat to a substance already overcharged with it is an adulteration, both unhealthy to the body and unpleasant to the taste, more especially such greases as that of tallow.

The mineral substances employed in the making up of chocolate are, according to Mr. Mitchell, some of the ochres, both red and yellow. These earths are used for the purpose of giving weight, and also to give the colour of cocoa to the vast quantities of starch with which the chocolate and cocoa is adulterated.

Dr. Normandy, who has devoted much time and patient research to the adulterations of chocolate, expresses himself very strongly on the subject.

Many of the preparations of the cocoa-bean, sold under the names of chocolate, of cocoa flake, and of chocolate powder, consist of a most disgusting mixture of bad or musty beans, with their shells, coarse sugar of the very lowest quality, ground with potato starch, old sea biscuits, coarse branny flour, animal fat (generally tallow, or even greaves). Cocoa powder is sometimes made of potato starch, moistened with a decoction of husks, and sweetened with treacle; chocolate is also made of the same materials, with the addition of tallow and ochre. Chocolate, in which either brick-dust or red ochre had been introduced, to the extent of twelve per cent., is commonly sold as a pure and genuine article. An instance is given of chocolate having been purchased which contained twenty-two per cent, of oxide of iron, the rest being starch, cocoa-beans with their shells, and tallow.

It is a common practice to extract from the cocoa-bean the rich fat or butter which it contains, for the purpose of selling it to druggists, to be used as a medical preparation, and then, in order to replace it in the chocolate, animal grease and tallow is employed.

Genuine chocolate is of a dark *brown* colour; that which is adulterated is of a red hue.

To detect the presence of animal fats and oils used in adulterated cocoa, and also to discover what kind of fat it is, the following simple process is recommended:—Mix powdered cocoa or chocolate with an aqueous solution of caustic potash; boil the mixture, and when the fat has been turned into soap, dilute the mass with a sufficient quantity of water, and filter three or four times. The milky filtrate, which is, in fact, a solution of soap, should now be supersaturated with nitric acid; this will separate the fat, which will float on the liquor, on cooling. On rubbing a small portion of it between the fingers the odour will generally indicate its origin. Heating it will also give a similar result. Pure cocoa butter has no odour.

When cocoa has been mixed with boiling water, if

on allowing it to cool it forms a gelatinous mass, it has been largely adulterated with starch, and similar substances.

The presence of ochre, brick-dust, or other earthy or mineral substances may be easily detected by burning the suspected cocoa in the air. If the ash is *grey* the cocoa is pure, if red or yellow it is adulterated. Or if the cocoa is thrown into cold water, and the mixture agitated briskly for a few minutes, and then allowed to set for a short time, the earthy matter being heavier than cocoa will have subsided, and on decanting the supernatant liquor, the sediment may be leisurely examined.

Although the adulteration is forbidden by Act of Parliament (43 George III.), and a fine of £100 threatened to all offenders, still the temptations of large profits are much stronger than the fear of the law, and it is almost an impossibility to obtain pure cocoa in London. Out of fifty-six samples that were examined only eight were genuine. Out of the samples of chocolate, none were unadulterated, and six contained ochre and earthy colouring matter.

In Dr. Pereira's treatise on food and diet we read, that although chocolate or cocoa do not disturb the nervous functions like tea and coffee, yet it is difficult of digestion, on account of the large quantity of oil which it contains, and is therefore very apt to disturb the stomachs of dyspeptics, and of others troubled with weak digestion.

If in its purest form cocoa is difficult of digestion, what must be the effect when it is saturated with tallow, and coloured with ochre or brick-dust.

Coffee.

Coffee is the seed of a tree supposed to be indigenous to Abyssinia, from whence it was, in the fifteenth century, introduced into Arabia, and extensively cultivated in the kingdom of Yemen. The

most highly prized coffee plantations, and those which are supposed to produce the finest berries, are those situated around the city of Mocha. It is only within the last 120 years that coffee has been introduced into and cultivated in America.

The coffee tree in its natural state often attains a height of forty feet, but, to facilitate the picking of the crops, it is seldom permitted to exceed ten or twelve feet. In Arabia, this tree is always covered with flowers and fruit. The leaves resemble the common laurel. Its fruit resembles that of the cherry tree, but it grows in clusters, and has a pleasant, slightly acid taste. As the fruit ripens it is gathered, and inside it is found sometimes four or three, but generally two, blackish-red berries, such as are imported into and sold in this country.

There are different ways of extracting these berries from the fruit. In Arabia, the fruit is permitted to ripen on the tree until it drops off, and it is then dried in the sun. In other countries, the pulp is picked off, or the fruit is passed between rollers, and, after being crushed, it is macerated in water until the berry separates from the pulp.

The liquor or decoction made from the roasted berry was first introduced into England by Mr. Daniel Edwards, a Turkey merchant, in the year 1652. He brought with him a Greek servant, called Pasquet, to make coffee for him, who was the first person that ever set up a coffee-house.

The varieties of coffee are distinguished in commerce according to their places of growth; but their colour seems to be the best indication of their physical properties. Arabian or Mocha coffee is small, and dark yellow. Java and East Indian kinds are larger, and paler yellow. The Ceylon is more analogous to the West Indian kinds, which, as well as the Brazilian, have a bluish or greenish-grey tint.

The active chemical substances in coffee are a volatile oil—which, when heated, emits an odour

precisely similar to that of roasted coffee—tanno-caffeic acid, and caffeine, identical with theine (*vide* article *Tea*). These three ingredients, to the congenial action of which the effects produced by coffee must be attributed, are similar to those contained in tea. In tea, according to Professor Johnston, the proportion of volatile oil amounts to about one pound in a hundred of the dried leaf, but in roasted coffee it rarely amounts to more than one in fifty thousand; but yet on the different proportions of the oil which they severally contain, the aroma, and the consequent estimation in the market, of the different varieties of coffee in a great measure depend. A higher aroma would make the inferior Ceylon, Jamaica, and East Indian coffees equal in value to the finest Mocha, and M. Payen asserts, that if the oil could be produced for the purpose of imparting this flavour, it would be worth in the market as much as £100 sterling an ounce. . . . . The oil is formed during the roasting, by the action of the heat on some substance present in the natural bean, probably in small quantity only. The effect of this oil is to excite the nervous and vascular systems, and to prevent the waste of the tissues, in as great a degree as caffeine itself.

The infusion or decoction of coffee forms a well-known favourite beverage. Like tea, it diminishes the disposition to sleep, and hence it is often resorted to by those who study by night. In some constitutions it acts as a mild laxative. Taken moderately, it is a wholesome and nutritive beverage; but its excessive use is said to produce various nervous disorders, such as trembling, despondency, palpitation, feverishness, and disordered vision.

Coffee is also said to possess peculiar medicinal properties. The prevalence of gravel in France is supposed to have abated, owing to the great quantities of coffee consumed in that country. In Turkey, not only the gravel, but also the gout, is said to be almost unknown; and in the *Pharmaceutical Journal*, vol.

xiii. p. 330, a case is mentioned of a gentleman who, after suffering severely from gravel for twenty-five years, was indebted to the use of coffee for his cure.

When the report of the *Lancet's* "Analytical Sanitary Commission" first appeared, it proved to what an enormous extent coffee was adulterated with chicory. Some time afterwards a Treasury minute was issued, legalizing the adulteration of coffee with chicory. This "legalization of adulteration" gave rise to every species and degree of fraud and sophistication in these articles. Mr. D'Israeli, when Chancellor of the Exchequer under Lord Derby, announced his intention to withdraw the Treasury minute. Before he was able to do so, however, a change in the Government took place, and Mr. Gladstone, the new Chanlor of the Exchequer, made an alteration in the law regarding the sale of coffee and chicory, by which coffee and chicory can be sold together, provided the words "mixture of chicory and coffee" be printed outside the package containing them. The *Lancet*, which in the meanwhile had not ceased to call attention to the shameful nature of the adulterations, then published a fresh report on the subject of coffee, in order to show whether or no the interests of the coffee-consumer were protected by the new law. In the report it appeared—

"1. That of thirty-four samples, *all purchased as coffee*, only three were genuine, while no less than thirty-one contained various proportions of chicory.

"2. That in one of the samples chicory was present in the proportion of about one-third of the article.

"3. That in twenty-two of the samples chicory formed about one-half of the article.

"4. That three of the samples consisted almost entirely of chicory.

"5. That thirteen of the samples were not labelled 'mixture of chicory and coffee,' and yet ten of them were adulterated with chicory.

"6. That the remaining twenty-one samples, not-

withstanding that *coffee* was distinctly asked for in each instance, were labelled 'mixture of chicory and coffee.'"

The great absurdity of the "mixture" regulation —to say nothing of the absurdity of not making coffee and chicory distinct articles of sale — is that the dealer is left at liberty to assure his customer that he is purchasing coffee mixed with but a small proportion of chicory, when in fact he may be buying a pound of "mixture," into the composition of which not more than an ounce of coffee enters.

The simplest way of detecting an adulteration of chicory in coffee is to shake a teaspoonful of the suspected mixture in a little cold water. If it is pure coffee, it will float on the surface, and communicate scarcely any colour to the liquid, whilst chicory will rapidly fall to the bottom, and imparts a deep red tint to the water.

The amount of chicory employed for adulterating coffee ranges from 20 to 75 per cent. That which contains the greatest portion of chicory is usually sold in canisters. Even from the smell the chicory can be detected, for it has a peculiar earthy odour, very different from that of coffee. Dr. Normandy purchased coffee containing 75 per cent. of chicory, in one of the largest and, to all appearance, most respectable shops in the Kingsland-road. On remonstrating with the tradesman, he only got abuse for his pains. The price of chicory is between 3*d.* and 4*d.* a pound, whilst coffee cannot be purchased, even at the cheapest dealers, under 1*s.* 2*d.* The temptation of the large profit to be realized by selling the cheaper article for the dearer is therefore very great. Chicory is to the grocer what water is to the milkman.

Dr. Thomson mentions a curious instance of an attempt at the adulteration of coffee. A large cargo of lupines was imported from Egypt, but the importers could not make any use of them, in conse-

quence of their bitter taste. He was consulted on the point, and requested to give a certificate in favour of that substance being equal to coffee. He examined it, and found that it was no more like coffee than roasted rye was. But he found that the bitter principle could be extracted by water, and advised the owner of the lupines to subject them to the action of water, and then dispose of them for feeding cattle or pigs.

Coffee is also occasionally adulterated with roasted corn. Dr. Normandy found roasted corn in coffee, to the extent of 25 per cent., which he easily recognised, by the size and character of the starch-granules. This roasted corn consists of the barley rye. If coffee has been adulterated with this ingredient, when boiling water is poured upon it, portions of the ground grain will, from capillary attraction, rise or climb up along the sides of the cup, and collect on the top and the edge, so that they may sometimes be separated in considerable quantities.

Some time since an apparatus was invented, patented, and used, for making substances, such as chicory, to resemble in shape coffee-berries. It acted on a similar principle to the bullet-mould, and compressed the chicory, or whatever the substance might be, into the form of the coffee-berry, and the imitation was very good, and considered to be excessively ingenious.

It appears, then, that Government not only refuses to prevent the public from having adulterated articles sold to them openly as genuine, but that it absolutely grants protection to the inventors of machines for producing the adulterating substances.

Tea.

The plant or shrub from which we procure our tea is a hardy evergreen, varying in height from three to seven feet, and belongs to the same family as the

well-known Camellias. The leaves are seldom plucked until the tree has attained its fourth year, when it will yield as many as four crops in the course of a season.

The two varieties of shrubs from which the tea of commerce is obtained are known respectively as *Thea bohea* and *Thea viridis*, the former yielding the black, the latter the green tea. It is a matter of doubt with botanists whether both these plants do not belong to the same species, though their appearance and character would lead to a contrary supposition. An excellent authority, Mr. Robinson, in his "Account of Assam," says, "The green and black, with all the diversities of each, are mere varieties produced by a difference in the culture, qualities of soil, age of the crop when taken up, and the modes of preparation for the market." On the other hand, Mr. Reeves, whose judgment on such a question is entitled to every consideration, is astonished "that any one who has been in China, or indeed any one who has seen the difference in the colour of the infusions of black and green tea, could suppose for a moment that they were the produce of the same plant, differing only in the mode of curing; particularly as they do not grow in the neighbourhood of each other."

The principal varieties of black teas are bohea, congou, campoi, souchong, caper, and pekoe, of which the last mentioned is the best. Bohea is the lowest grade of black tea. The green teas include twankay, hyson-skin, hyson, imperial, and gunpowder.

According to M'Culloch, gunpowder-tea stands in the place of the pekoe, being composed of the unopened buds of the spring crop. Imperial, hyson, and young hyson consist of the second and third crops. The light and inferior leaves, separated from the hyson by a winnowing machine, constitute hyson-skin.

The effects of tea are due to three active chemical substances—the volatile oil, the theine, and the tannin. The volatile oil gives it the peculiar flavour; when obtained pure, it is of a lemon-yellow colour,

is lighter than water, and has the taste and smell of tea. It possesses strong narcotic properties, which are, however, corrected by the tannin. Theine is a substance, identical with caffeine, which may be extracted from tea, and, when pure, has a bitter taste, and crystallizes in fine glossy needles, resembling white silk. When introduced into the stomach, as in an infusion of tea, its effect stays the waste of the body, and, consequently, diminishes the necessity or desire for food to repair it. This was proved by the experiments of Mulder, who gave small doses (half a grain) of theine to rabbits, and he found that, although in good health and condition, they ate little, and seldom evacuated. It is this peculiar property of tea which renders it so acceptable to the poor, for whilst it cheers the spirits, it also removes the desire for food. It is a common thing to hear women exclaim that they almost exist upon tea; but the phenomenon is not such an extraordinary one, after all; for it is no more than what many Asiatics do. With the old and infirm, where the stomach is too weak to digest the ordinary forms of food, tea acts almost medicinally, checking the sinking of the body, and repairing the wear and tear of the tissues. Professor Liebig asserts that theine contributes to the formation of bile, and indeed shows that its chemical equivalents are similar to those of taurine, the nitrogenized compound peculiar to bile. If, therefore, this product can be obtained from tea instead of from the change of matter in the tissues, it, of course, causes a great economy of the human frame.

The tannin or tannic acid is the substance which gives the astringent taste to tea. It is so called from being the ingredient in bark so generally employed for tanning leather. It forms from thirteen to eighteen per cent. of the whole weight of the dried leaf.

These three chemical substances may be considered as the active constituents of the tea-leaf, but it also contains a large quantity of what chemists call gluten,

which is the most nutritious of vegetable substances. It is this gluten which gives to bread its life-supporting powers. In wheaten bread the proportion of gluten averages, according to the country where the corn is grown, from nineteen to twenty-four per cent., whilst in the tea leaf it averages from twenty to twenty-five per cent. But gluten is, unfortunately, insoluble in hot water, so that when we, as it is called, make tea, we leave unemployed in the tea-leaves the greater proportion of their nutrition. It appears negligent to cast away, as it were, so much food, when, by adding a little soda to the water, it might be employed; for, as we learn from Professor Turner, a dilute alkaline solution dissolves gluten, apparently without its being decomposed. In South America the inhabitants appear to be fully cognizant of this important property of tea; for, after the infusion has been partaken of, it is the custom (according to Captain Basil Hall) for the exhausted leaves to be handed round to the company and eaten as food. In this manner both the exhilarating and the nutritive effects of the plant are taken advantage of. The Tartar tribes also prepare their tea in a manner which extracts all the nutriment in the leaf. The water of the steppes is strongly alkaline, and having reduced the tea to a fine powder, they boil it, and, as we have said before, the salts in the water have the property of dissolving the gluten. They daily drink from twenty to thirty cups of the decoction, mixed with milk, butter, and roasted meal; on this they almost entirely exist.

Teas are very much adulterated, not only in England, but also in China. From Mr. Fortune, who himself witnessed the process employed by the Chinese for giving an artificial colouring to green tea, we gather the following particulars of the process:—"The superintendent takes a portion of Prussian blue, throws it into a porcelain bowl, not unlike a mortar, and crushes it into a very fine powder; at the same time a quantity of gypsum is burned in the charcoal fire over which the tea is roasting. This

gypsum having been taken out of the fire after a short time, readily crumbles down, and is reduced to powder in the mortar. The two substances thus prepared are then mixed together, in the proportion of four of gypsum to three of Prussian blue, and forms a light blue powder, which is then ready for use. This colouring matter is applied to the tea during the last process of roasting. About five minutes before the tea is removed from the pans, the superintendent takes a small porcelain spoon, and with it he scatters a portion of the colouring matter over the leaves in each pan. The workmen then turn the leaves rapidly round with both hands, in order that the colour may be equally diffused. To fourteen pounds of tea about one ounce of colouring matter is applied. During this part of the operation the hands of the workmen are quite blue."

The Chinese acknowledge that tea is much better without such ingredients, and that they never drink dyed tea themselves; but remark that foreigners seem to prefer having a mixture of Prussian blue and gypsum with their tea, to make it look uniform and pretty, and as these ingredients are cheap enough, they have no objection to supply them, especially as such teas always fetch a higher price.

Indigo is at present said to be used in place of Prussian blue, the latter having been discovered by the Chinese (thanks to the representations of European writers) to be highly injurious. Most chemists consider the adulteration with indigo almost a harmless one, but at the same time, of course, they do not attempt to justify it. The same may be said of Prussian blue; when this substance is used, not more than a quarter of a grain of Prussian blue goes to each ounce of tea. Besides this, Professor Taylor states distinctly that Prussian blue is not a poison.

The adulterated tea manufactured in China under the appropriate name of lie tea, and of which half a million pounds weight is imported annually into this country, consists of the sweepings of the tea ware-

houses, mixed with rice-water, and rolled into grains. It is made either black or green, and with the acknowledged purpose of adulterating other teas. Genuine teas yield only from five to six per cent. of ash, while lie tea yields from thirty-seven to forty-five *per cent.*, thus indicating the large amount of dust and other impurities with which it is mixed.

Mr. Warrington, in a paper read before the *Chemical Society*, states that the importers of tea have had the coolness to endeavour to pass their lie teas through the Custom House as "manufactured goods"—a title which they certainly deserve.

The processes peculiar to the preparation of black tea are styled Leang-Ching, To-Ching, and Oc-Ching, and these all consist in carefully watched and regulated processes of heating the leaves until a certain degree of fragrance is developed. The leaves are said to wither and give, and become soft and flaccid. The utmost care, practical skill, and experience are required in the properly conducting these operations, and as soon as the proper point is arrived at, the leaves are to be immediately removed to the roasting pan.

After being roasted and rolled two or three times, they are then to be dried, and this is effected in a cylinder of basket-work, open at both ends, and covered on the outside with paper; it is about two and a half feet in height and one and a half in diameter, which diameter is diminished in the centre, as in a dice-box, to one foot and a quarter. This stands over and round a small charcoal fire, and is supplied with cross-bars about fourteen inches above the fire, on which an open sieve containing the tea is placed. A small aperture, about an inch and a half in diameter, is made in the centre of the tea with the hand, so that an ascending current of air and the products of the combustion pass through and over the tea contained in the sieve. A circular, flat, bamboo tray is placed partially over the mouth of this basket-work cylinder, and most probably serves to regulate the

rapidity of the ascending current, and prevent the admission of the cold air to the leaves, and at the same time allow a sufficient outlet for the generated watery vapours and the products of combustion.

At the commencement of this operation, the moist leaves are still green, and retain their vegetable appearance; after the drying has continued about half an hour, the leaves are turned, and again submitted to the heat for another half-hour; they are then taken out, rubbed and twisted, and after sifting away the small dust, again returned to the sieve and drying tube. This operation of sifting is very necessary, to remove any of the small tea or dust which might otherwise fall through the meshes of the sieve on to the fire, as the products of their combustion would deteriorate and spoil the flavour of the tea.

The leaves have now begun to assume their black colour; the fire is diminished or deadened by ashes, and the operation of rolling, twisting, and sifting is repeated once or twice until they have become quite black in colour, well twisted, and perfectly dry and crisp. They are then picked, winnowed, and placed in large quantities over a very slow fire for about two hours.

Now that this black colour is not owing to the fire is evident; for in cases mentioned by Mr. Ball, where the leaves have been dried in the sun, the same colour is obtained; and on the other hand, if roasted first, without the process of fermentation or withering, and then finished in the poey-long, a kind of green tea is produced.

In the operations for the manufacture of green tea, on the contrary, the freshly picked leaves are roasted at once, without delay, at a high temperature; rolled and roasted again and again, assisted sometimes with a fanning operation to drive off the moisture; and always with brisk agitation until the drying is completed.

One of the sophistications which has been carried on in this country to some extent, consists in giving the appearance of green to an imported black tea.

The material used as the basis for this process of manufacture is a tea called scented caper; it is a small, closely rolled black tea, about the size of small gunpowder, and, when coloured, is vended under this latter denomination; the difference in price between the scented caper and this fictitious gunpowder being about 1*s.* per lb., a temptation sufficient to induce the fraud. This manufacture was carried on some time since at Manchester, and was kept as secret as possible. It appears that it was generally mixed with other tea, so as to deceive the parties testing it. How this manufacture was conducted it is impossible to say; but some preparation of copper was employed, as the presence of that metal was readily detected. It is stated, however, that this sophistication has ceased.

Another adulteration of the most flagrant kind is practised in China. Some of the black teas, styled scented caper, and the teas called green gunpowder, present a very remarkable appearance. They are apparently exceedingly closely rolled, and very heavy. They possess a very fragrant odour. The black tea is in compact granules, like shot of varying size, and presents a fine glossy lustre, of a very black hue. The green is also granular and compact, and presents a bright pale bluish aspect, with a shade of green, and is so highly glazed and faced, that the facing rises in clouds of dust when it is agitated, or poured from one vessel to another; it even coats the vessels or paper on which it may be poured. To produce this high colour in green tea, the Chinese make use of pale Prussian blue, a yellow vegetable colour, which we now know to be turmeric, and a very large proportion of sulphate of lime. The facing from the sample of black tea is perfectly black in colour, and on examination was found to consist of earthy graphite, or black lead.

On submitting these teas to the action of hot water, it will be found that a large quantity of sand and dirt subsides; which, if separated by decantation, and collected, will be found to amount to about fifteen

in the hundred parts. Whilst immersed in the boiling water no expansion or uncurling of the leaf will take place, as is generally to be observed when heat is applied to a genuine tea; in fact, it is quite evident that there was no leaf to uncurl, the whole of the tea being in the form of dust. The question next presents itself as to how these materials had been held together, and this is readily solved; for, on examining the infusion resulting from the original soaking of the sample, abundant evidence of gum is exhibited.

Thus we have, then, in these samples a mixture of tea-dust with dirt and sand, agglutinated into a mass with a gummy matter, most probably manufactured from rice-flour, then formed into granules of the desired size, and lastly dried and coloured, according to the kind required by the manufacturer, either with black lead, if for black tea; or with Prussian blue, gypsum, or turmeric, if intended for green.

When the tea arrives in England, it undergoes a second course of adulteration and colouring. The merchants have learned the art of emptying the chest, in such a manner that the curiously neat soldering, with which the casing of lead is closed, is not injured, and no traces left of the contents having been tampered with. Through the small round hole made in the top, for the purpose of taking out samples, the whole of the contents are emptied on a clean floor, and the tea mixed with whatever composition it is thought fit to add, or worked up with teas of an inferior quality, such as those which, by themselves, would be unsaleable. After this operation, the tea is poured back into the metal case, and the foot or hand introduced through the small opening, for the purpose of pressing it down and packing it up tightly. Therefore, to purchase a chest even from a wholesale dealer is not always a certain guarantee that the tea is good and pure. Magnesia may have been added, to give a glossy appearance, and Prussian blue, to give a rich high colour. A certain good undesignedly arises out of the use of this magnesia, for it enables the hot water

to extract the gluten from the leaf; but it is not from this charitable motive that the dealer employs it.

A distinct trade is carried on in selling certain materials for the sole object of adulterating tea. That called "veno beno" is largely manufactured. It consists of about 90 per cent. of catechu—a vegetable extract, also employed by tanners as terra japonica—and the remaining 10 per cent. is made up of tea-dust and broken leaves. The manufacturers of this compound endeavoured, a short time since, to establish a retail trade for its sale, and advertised it largely at sixpence per packet; but the public apparently declined to become such good purchasers as the wholesale dealers, and now the article is entirely vended for adulterating purposes.

The leaves employed for mixing with tea are usually those of the sloe and hawthorn, although others are sometimes made use of. An ingenious practice is also in vogue of making the exhausted tea-leaves perform duty a second time. It is the custom of certain persons to call at hotels and coffee-shops, where large quantities of tea are consumed, and purchase the already used leaves. They are dried, prepared with coloured facings, recurled, and a second time sold as genuine tea.

The Chinese not only mix Prussian blue with their tea, but they also enclose in the curled-up leaves an immense quantity of iron filings, to render them heavy, so that it not unfrequently happens that when a chest has been much tossed about, and the leaves have broken, a layer of filings, nearly equal to one-third of the whole, will be found at the bottom of the package. If a magnet is thrust into a tea heap or a chest, it not unfrequently is found, on withdrawing it, to be covered with small particles of iron.

To find out whether the tea has been coloured with Prussian blue, the better plan is to shake the leaves with a steady mechanical motion, for some time, so as not to break them, when a quantity of powder will separate from them. From this dust, by means of a

powerful magnifying-glass, blue particles may be discerned; they are to be taken up with a moistened paint brush, and placed upon glass. On adding a little water, crushing them between two pieces of glass, blue streaks will appear in the liquid, provided Prussian blue is present. They can be distinctly seen by means of the microscope. If there is any doubt remaining as to whether the colour is due to Prussian blue or not, it may be further tested by a drop of caustic potash being introduced between the glass, by capillary attraction, when the blue tint becomes converted into a dark brown, and the original colour again returned by employing, in a similar manner, a little dilute sulphuric acid.

Another plan for detecting the presence of adulterating substances in tea can be determined—if the tea be "faced"—by scraping some of the leaves with a penknife, and examining the particles that come from them by means of the microscope.

The presence of lie tea is determined by the amount of ash left by the so-called "tea," after incineration. Genuine tea yields only from five to six per cent. of ash; while lie tea, as has been before observed, sometimes gives as much as forty-five per cent.

Until lie tea be rendered liable to confiscation and destruction, there will evidently be no chance of obtaining wholesome tea, at low prices, in any part of the British empire.

In China tea is commonly sold at taverns, as beer and spirits are with us. A Chinese poet, writing on tea, gives the following description of its beneficial effects. "It tempers the spirits, and harmonises the mind; dispels lassitude, and relieves fatigue; awakens thought, and prevents drowsiness; lightens and refreshes the body, and clears the perceptive faculties."

This panegyric on the author's national drink is corroborated by Dr. Pereira's more quiet and philosophic account of the benefits of tea-drinking. "The effects of tea are familiar to most persons. It is a common practice with those who desire nocturnal study to use

tea; and on the same principle it may be employed as an antisoporific to counteract the effects of opium, and to relieve the stupor of fever. As a diluent and sedative it is well adapted for febrile and inflammatory disorders, and most persons can bear witness to its good effects in these cases. To its sedative influence should also be ascribed the relief of headache, sometimes experienced by the use of strong tea. In colds, catarrh, and slight rheumatic cases, warm tea is used as a diluent, diaphoretic, and diuretic. . . . . Tea possesses a specific and marked influence over the functions of the brain."

Strong green tea is apt to occasion in some constitutions nervousness and very severe effects. It gives rise to tremor, anxiety, sleeplessness, and most distressing feelings. Part of these effects are due to the use of so much aqueous liquid, to the milk and sugar used in it, or to the action of the tannin (in the tea) on the digestive liquid, for, according to Schwann, it forms a precipitate with this fluid, and renders it inert. Therefore the English custom of drinking tea so soon after dinner is unwholesome, and impedes the process of digestion.

MANUFACTURED AND INTOXICATING DRINKS.

Porter, Beer, Stout, and Pale Ale.

The reason why these beverages are called malt liquors is because they are, or at least should be, made from infusions of malted barley. Beer is an extremely ancient and highly esteemed drink, for in most countries the inhabitants have from time immemorial been accustomed to brew beverages called beer. The Danes were acquainted with the process, and so were the Picts. There are Irish and Scotch traditions that this beer was made with heather; but, as Professor Johnston remarks, it is just possible that the grain of truth contained in this tradition may be that they *flavoured*

their barley-wort with twigs of flowering heather, or that they used the narcotic gale, which grows among the heather, to give a bitter flavour and more intoxicating quality to the liquor. In Russia and China, the inhabitants have not only for ages drunk beer, but they also knew the art of adulterating it with the seeds of the thorn apple, to make it heavy and intoxicating. Long before the Spanish conquests in America, the natives made a drink by preparing Indian corn as the English maltsters do the barley. It is to this day so much prized by the Indians, that there is scarcely a hut without a jar of the favourite liquor. In the valleys of Sierra, a drink called *chica* is manufactured, which, although the brewing process is somewhat extraordinary, is still a beer. It is made by chewing dried maize (malt), and depositing the pulp in a jar. It is then mashed in hot water, and the liquor poured off into tubs, to allow it to ferment. Disgusting as this manufacturing process is, it nevertheless depends upon the same chemico-physiological principles as our own brewing, for the saliva possesses the property of converting starch into sugar; and it is only to obtain a similar result that barley is malted, bruised, and digested in hot water.

The Crim Tartars possess a favourite drink, called *bonza*, or millet beer, prepared by melting and fermenting millet seeds. The Arabians, Abyssinians, and many of the wild tribes of Africa obtain from seeds an intoxicating beverage which they call beer; and on the southern slopes of the Himalaya the natives have for ages been in the habit of moistening millet seeds, permitting them to ferment, and then use them as we do our tea, by pouring hot water on them, and drinking the infusion whilst it is still hot; this *murwa*, as it is called, has the taste of "negus of Cape sherry, rather sour," and although extremely weak, is still, according to Hooker, a very pleasant beverage. The Tartars have a drink called *koumiss*, which is a beer made from mare's milk. "The milk is diluted with a sixth of its bulk of water, a quantity of rennet, or,

what is better, sour koumiss, is added, and the whole is covered up in a warm place for twenty-four hours. It is then stirred or churned together, till the curd and whey are ultimately mixed, and is again left at rest for twenty-four hours. At the end of this time it is put into a tall vessel, and agitated till it becomes perfectly homogeneous. It has now an agreeable sourish taste, and in cool places may be preserved for several months in close vessels. It is always shaken up before it is drunk. This liquor, from the cheese and butter it contains, is a nourishing as well as exhilarating drink, and is not followed by the usual bad effects of intoxicating liquors."

According to M. Payen, the beer annually consumed in Paris amounts to between four and five million gallons.

The English porter was invented by a brewer of the name of Harwood. It was first introduced in the year 1730. Before that time the British coalheaver had been forced to quench his thirst with thin ales and small beer. The new drink rose rapidly in favour, each year increasing in popularity, until in the present day it almost excludes the manufacturing of ales from the principal breweries in the metropolis, and we hear of London porter and country ales. For brewing porter and stout, malt and hops should be the only ingredients, and the colour, odour, and flavour should be entirely owing to them.

The peculiar flavour which distinguishes these beers is owing to the degree of heat with which the malt has been dried, and also to the thoroughly ripe condition of the hops employed in its manufacture. The malts are a mixture of pale and high dried or charred; the pale kind being used to give body or strength, the dark kind to communicate the colour. When first brewed, this beer does not possess the well-known colour and flavour; this is obtained from employing malt, charred by roasting it in a somewhat similar manner to coffee.

Malt is barley which has been moistened until ger-

mination has commenced. For this purpose it is steeped in water tanks till the grain is well swollen, when it is spread out on the floor of a dark room to heat and sprout, care being taken to turn it over from time to time. If much light were admitted, the barley would grow too soon. When the germ has reached two-thirds of the way up the grain (shown by the swelling), the germination is stopped by slowly drying the barley on a kiln.

The object in allowing the grain to sprout is to change the starch contained in it into sugar. The principal substances contained in barley are gluten and starch. These substances undergo a chemical change as the sprouting continues. First, the gluten is decomposed, and a substance called dyastase produced, which in its turn decomposes the starch, which is changed into grape-sugar.

Before the malt is introduced into the mash-tub it has to be bruised. It is then macerated with water, heated to about 160° Fahrenheit. By this means the sugar which has been found in the grain is, together with the dyastase, thoroughly dissolved. This latter substance also converts into grape-sugar the starch still remaining in the seed.

Hops are supposed to have been first employed in the manufacture of beer by the Germans. They were introduced into the Netherlands, and first used in the breweries, about the end of the thirteenth century. They are generally believed to have been brought into this country about the year 1524 by Henry the Eighth.

When the season is favourable, the hops grown in England are more than sufficient for all the beer brewed in the year, but occasionally, when the black fly or the mould have damaged the crops, we are obliged to import from Belgium, Germany, and America. The hop requires much sun and a rich moist soil. In hop counties an acre of good land will sell for as a high a sum as three or four hundred pounds, proving how remunerative the cultivation must be.

Hops are used in brewing because they impart a pleasant, aromatic, and bitter taste to the liquor; they also give it an apparent strength, for this plant has a narcotic property. They also have some peculiar chemical effect upon the beer, clarifying it, and preventing the fermentation from passing into the acetic by stopping it at the alcoholic stage. Before hops were brought to England, beer could not be kept for more than a month without its becoming sour. "The use of hoppes," says Parkinson (1640), "to be put in beere, altereth the quality thereof, to be much more healthful and rather physicall, to preserve the body from the repletion of grosse humours, which the ale engendereth."

There are five qualities of hops grown. The *Goldings*, from mid and east Kent; the *White-bines*, from Farnham and Canterbury — both of them highly esteemed, and principally used for making bitter beer. The *Jones's* rank next in the opinion of brewers. For common sorts of beer the *Grape* is employed. The *Colegate* is a rank and strong-bearing hop, but (unless passed off as *Goldings*) is looked upon as the worst hop grown.

The hop yields, upon distillation, a volatile oil of a brownish-yellow colour, distinguished for its strong odour of hops, and slightly bitter taste. It is on account of the escape of this oil that hops lose so much in value by keeping. Many chemists also consider that it is this volatile body which gives to the hop its narcotic qualities.

Notwithstanding the numerous Acts of Parliament which have from time to time been passed, to prevent the adulteration of beer, still the practice has in nowise abated. As the cask leaves the brewer, we have no doubt, judging from the samples we have ourselves examined, that the liquor is genuine and good; but when once it has been placed in the cellar of the publican, then the doctoring begins, until by the time it reaches the consumer, instead of a cheering and strengthening drink, he is forced to swallow a poison-

ous and destructive concoction. It is the competition of threepence a pot against fourpence a pot that causes these iniquitous and health-destroying results. Forty years ago adulteration was carried on to an alarming extent. In 1820, a book was published entitled "Practical Treatise on Brewing," which went through twelve editions. Mr. Child, the author, in a chapter on Porter, and the various adulterating ingredients to be used, says, "However much they may surprise, however pernicious or disagreeable they may appear, I have always found them requisite in the brewing of porter, and I think they must invariably be used by those who wish to continue the taste, flavour, and appearance of beer. And though many Acts of Parliament have been passed to prevent porter brewers from using many of them, yet I can affirm, from experience, that I never could produce the present-flavoured porter without them. The intoxicating qualities of porter are to be ascribed to the various drugs intermixed with it. It is evident some porter is more heady than others, and it arises from the greater or less quantity of stupefying ingredients. Malt, to produce intoxication, must be used in such large quantities as would very much diminish, if not totally exclude, the brewer's profit."

This same gentleman gives the following receipt for porter:—

1 quarter of malt.
8 lbs. of hops.
9 lbs. of treacle.
8 lbs. of liquorice root.
8 lbs. of essentia bina.
8 lbs. of colour.
Capsicum, half an ounce.
Spanish liquorice, 2 ounces.
Cocculus Indicus, a quarter of an ounce.
Salt of tartar, 2 drachms.
Ginger, 3 ounces.
Lime, 4 ounces.

Linseed, 1 ounce.
Cinnamon, 2 drachms.

The essentia bina "is compounded of 8 lbs. of moist sugar, boiled in an iron vessel (for no copper one would withstand the heat sufficiently), till it comes to a thick syrupy consistence, perfectly black, and extremely bitter."

Colour "is comprised of 8 lbs. of moist sugar, boiled until it obtains a middle state, between bitter and sweet, and which gives to porter that mild, mellow colour usually so much admired."

The heading "is a mixture of half alum and half copperas, ground to a fine powder, and is so called from giving to porter the beautiful head of froth which constitutes one of its properties, and which landlords are so anxious to raise to gratify their customers."

We are glad to say that Mr. Child's book is out of print.

Another gentleman, Mr. Morris, in his book on "Brewing Malt Liquors," strongly recommends, in the manufacturing of porter, the use of cocculus Indicus, sweet flag-root, quassia, coriander seeds, colouring, capsicum, caraway seeds, grains of paradise, ginger, beans, oyster-shells (to recover sour beer), and alum, to give the beer a smack of age.

"The colouring," he tenderly says, "gives a good face to beer, and enables you to gratify the sight of your different customers." In another place, he adds, "Beans tend to mellow malt liquor, and from their properties add much to its inebriating qualities; but they must not be used in too large a quantity. Cocculus Indicus is used as a substitute for malt and hops, and is a great preservative of malt liquor. It prevents second fermentation in bottled beer, and consequently the bursting of the bottles in warm climates. Its effects are of an inebriating nature," but he forgot to add that its nature is also poisonous.

One of Mr. Morris's receipts is as follows:—

Malt	20 qrs.
Hops	2 cwt.
Cocculus Indicus berry	4 lbs.
Sugar	28 lbs.
Fabia amara (Nux vomica)	6 lbs.

To make up a vat of 150 barrels :—

"Use half a barrel of colouring, a quarter of a hundred weight weight of cream of tartar, a quarter of a hundred weight of ground alum, one pound of salt of steel, and two barrels of strong finings. Mix these well together, and put them in a vat, rousing it thoroughly at the same time. Let the vat remain open three days, then close it and sand it over. In a fortnight it will be fit for use; your own good sense will inform you how to advantage."

About the year 1800, the constant use of drugs in adulterating beer tempted several men of little morality, and no fear of the law, to start in business as brewers' druggists. Mr. Accum, in his "Death in the Pot," states that "their trade spread far and wide, but it was amongst the country brewers that they found the most business."

"It was at the same time also," Mr. Accum further informs us, "that a Mr. Jackson, of notorious memory, fell upon the idea of brewing beer from various drugs, *without any malt and hops*. The chemist did not turn brewer himself, but he struck out for a more profitable trade of teaching his mystery to the brewers for a handsome fee."

Dr. Normandy, in his book "Commercial Handbook of Chemical Analysis," asserts that "It is a publicly known fact that carts may be seen bearing the inscription, in staring paint, of 'C——, brewers' druggist.' Such a cart I have myself seen a few days ago, standing in the broad daylight of mid-day, before a publican's shop or gin palace."

The "beer doctor" is also a well-known character. He visits the different public-houses and examines

the beer. If any of it is what is termed "sick," he administers to it the required remedies.

Mr. Child, in his book "On Brewing," advises the use of oil of vitriol for manufacturing old ale out of mild or new beer.

To the honour of our great London brewers be it said, that the porter and stout as it leaves their establishments is always pure. Not a single trace of intentional adulteration has, for the last twenty years, been brought against them.

The following are the principal constituents of beer:

Alcohol.
Starch sugar.
Dextrine (starch gum).
Extractive and bitter matters.
Fatty matters.
Aromatic matters.
Glutinous matters.
Lactic acid.
Carbonic acid.
Salts.
Water.

The average quantity of spirit contained in porter and stout is, according to Brande—

Brown stout	6·80
London porter	4·20
Ditto, four months in bottle	5·36
London small beer	1·28

Cocculus Indicus, one of the ingredients used by publicans in adulterating their beer, is the fruit or berry of the Menispermum Cocculus (Levant nut). It contains from one to two per cent. of a poisonous alkaloid (*picrotoxia*). The seeds, in powder or decoction, give rise to nausea, vomiting, and griping pains, followed by stupor and intoxication.

Mr. Taylor, in his book "On Poisons," says, "There are, so far as I am aware, only two well-authenticated instances of this substance having proved fatal to man. Several men suffered from this poison in 1829,

near Liverpool; each had a glass of rum strongly impregnated with cocculus Indicus. One died that evening, the rest recovered (Traill's Outlines, p. 146). Of the second case, the following details have been published:—'A boy, æt. 12, was persuaded by his companions to swallow *two scruples* of the composition used for poisoning fish. In a few minutes he perceived an unpleasant taste, with burning pains in the œsophagus and stomach, not relieved by frequent vomiting. In spite of treatment, a violent attack of gastro-enteritis supervened, and there was much febrile excitement, followed by delirium and diarrhœa, under which the patient sank on the nineteenth day after taking the poison.'

"This substance," Mr. Taylor adds, "is applied to no useful purpose whatever, either in medicine or the arts, and, under a proper system of medical police, its importation would be strictly prohibited."

There is no known antidote to this poison, a fact which renders its use still more dangerous.

Mr. Herapath detected the presence of cocculus Indicus in beer by the following test. He first boiled the beer with an excess of acetate of lead, so as to throw down all gum and colouring matter. He then evaporated the clear liquor, at a moderate temperature, until it became rather thick, and then it was heated with a little pure animal charcoal. After standing for some time, the charcoal was collected in a filter, washed with water, and dried at steam heat. The charcoal contained the picrotoxia, which was separated by boiling in pure alcohol, filtering, and evaporating to dryness. Picrotoxia is recognised by its forming feathery tufts of acicular crystals, or else by its producing out-shaped forms.

Dr. Normandy asserts that the publicans adulterate their beer largely with salt, to increase the thirst of the consumer, and also with sulphate of iron, for the purpose of giving froth and head to it, and also for imparting a kind of metallic smartness to the be-

verage. This gentleman was informed by two of the largest druggists in London, that cocculus Indicus, foots sugar, liquor ammoniæ, and extract of gentian were constantly sold by them to publicans, for the purpose of adulterating beer.

When the publican has diluted his beer with water, he adds a certain quantity of foots sugar, to restore the sweetness, which has, of course, been diminished. The liquor ammoniæ is employed for bringing back the colour, which has been rendered pale by the extensive dilutions the beer has undergone. For similar reasons, gentian is employed to restore the bitter flavour. "I am given to understand," says Dr. Normandy, "that the chief sale of gentian is to publicans."

Alum and sulphate of iron are also employed in small proportions by publicans for putting "the heading upon beer." We learn from Mr. Mitchell, that out of about 200 samples of beer, obtained from time to time from different public-houses, he had detected sulphate of iron in nearly every one of them.

Salt is almost always present, in small quantities, in porter as sent out by the brewers. It is said to assist in the preservation and fining of the wort; and these, it is alleged, are the only purposes for which it is employed by the brewer. The beer obtained direct from any of the large London breweries we have invariably found to be chemically pure, the principal ingredients being the extracts of malt and hops. Whenever salt has been present, it has been in very small quantities, and we have only been able to detect its presence by the most careful testing.

In a letter which we received from one of the principal London brewers, we found the following remarks upon the adulterations practised by publicans:—

"If you want to find out adulteration, however, you must not go to a brewery, but to a public-house. If the legislature would fine the publicans heavily, when pernicious ingredients were discovered in their beer, the public might get wholesome drink, and the

brewers credit for their manufacture; whereas, the better or the stronger we send our porter into the taverns the more they 'wash' it."

Ale is prepared with pale malt and, on this account, is of a much brighter colour than porter and stout. The strongest kinds of ale are richer in alcohol, sugar and gum than any other kind of malt liquor; "but," says Dr. Pereira, "though they contain a larger amount of nutritive matter, they are not fitted for ordinary use, on account of their intoxicating and stupifying qualities, and are especially to be avoided in diabetic and dyspeptic cases."

The pale ale, prepared for the Indian market, and therefore commonly called India Pale Ale, is, according to Dumas, "more highly charged with the essential oil of hops" than any other ale. It is free from the objections usually brought forward against the other kinds of ales. It is carefully fermented, so as to be devoid of sweetness, or, in other words, it is dry, and it contains double the quantity of hops usually employed for making other beers. Dr. Pereira states that "it forms a most valuable nutritive beverage for invalids and convalescents. It is taken with benefit by many persons on whom other kinds of ale act injuriously."

In preparing the malt for the manufacturing of bitter ale the greatest care and experience is required. It is essentially necessary to prevent the husk of the barley from charring, even in the slightest degree, and that the original straw colour of the grain should be maintained. In the selection of the hops, they should be picked as soon as sufficiently ripe to keep, and all brown or withered leaves should be carefully removed.

Some time since an absurd report was circulated which had the effect of throwing into the greatest alarm all bitter-ale drinkers. It was for a few months implicitly believed that strychnine, a deadly poison, was commonly employed by brewers in the manufacture of bitter beer.

At a lecture given at the *Conservatoire des Arts et Métiers*, it was stated by M. Payen, the vice-president of the *Conseil d'Hygiène et de Salubrité*, that strychnine was being made in large quantities in Paris, and that the French authorities had discovered that it was about to be sent to England, to be employed in the manufacture of the celebrated bitter beer of that country.

This statement, having appeared in the French papers, was copied into the English press. The bitter-beer brewers lost no time in denying in the strongest terms the accusation, and procured analyses from all the most eminent chemists in Europe of the purity of their manufactures.

It is needless to say that there had never been any grounds for the accusation. The only result of the silly commotion was, that the sale of bitter ale decreased for a time; that the brewers were out of pocket several thousand pounds, spent in analysing and proving the genuineness of their beer; and that the public were frightened into relinquishing a most wholesome and pleasant drink.

Strychnia is the active principle of nux vomica. It is remarkable for its intense bitterness, and is so deadly a poison, that *half a grain* has been known to prove fatal. The case is mentioned by Professor Taylor. Half a grain of the sulphate of strychnia was taken by Dr. Warner, in mistake for morphia. In a few minutes he was seized with constriction of the throat, tightness of the chest, rigidity of the whole muscular system, and tetanic convulsions. He died in about *fourteen minutes*, i. e., within the shortest period of time yet known, from the effects of this poison.

It is ridiculous to imagine that so speedy and terrible a poison could be used with any advantage by the brewers of bitter ale. To remove its evil effects, it would require to be so excessively diluted that its bit-

terness, the very property that could be of any value, would necessarily be destroyed.

The tests for the presence of strychnia in beer are so complicated, that our space will not permit us to enter into the subject.

The Burton brewers have long been celebrated for their beer. It is the general opinion that their success depends, in a great measure, upon the quality of the water used for brewing. This water contains a large quantity of sulphate of lime and the sulphates of potash and magnesia, and a considerable amount of carbonate of lime.

Bitter ale may almost be termed the wine of England. The Germans and the French have endeavoured to imitate this delicious drink, but without success. Although they employ the same amount of malt and hops, and closely follow the Burton method in their brewing, still the beer has not the same taste, neither does it appear to possess the same medicinal properties. The three principal brewing firms at Burton are those of Messrs. Bass and Co., of Messrs. Allsopp and Co., and of Messrs. Salt and Co.. We have carefully examined samples of all (both in bottle and drawn from the cask) manufactured by these celebrated houses, and have invariably found them to be all equally pure. At the Bow brewery of Messrs. Abbott and Co., a bitter beer is manufactured, which rivals the produce of Burton for genuineness and excellence; indeed, a spirit of friendly rivalry appears to exist among the pale ale brewers as to whose manufacture shall excel either as a pure and delightful beverage for the healthy, or as a valuable and strengthening tonic for the invalid.

There is another beer, which is very celebrated in Somersetshire, called the Stogumber pale ale. This ale is brewed with a peculiar water obtained from a spring, known at Stogumber as Harry Hill's Well. It is said to be possessed of several medicinal virtues,

and to be chemically similar to that at the cataract of Launceston, in Van Diemen's Land. We extract a verse from a song which has been composed in honour of the renovating qualities of this exeellent ale:—

"But one month since my legs were lank,
Each rib with ease I then could number,
But now I'm plump,—and how? I drank
Each day a pint of pale Stogumber."

All analyses prove that these ales contain only sufficient aleohol to stimulate without after-depression, and that the pleasant bitter flavour whieh they leave on the palate arises from the bitter extraet of hops, and not, as erroneously supposed, from the introduction of any adulterating chemical body.

Brandy.

By this name we, in this country, distinguish the ardent spirit which is obtained by the distillation of wine. It enjoys a peculiar taste and aroma, due to the presenee of minute proportions of a volatile oil obtained from the grape. Every variety of alcohol has the taste and smell charaeteristic of the fermented substanee from whieh it has been obtained. When the spirit has been distilled from wine, the flavour of the grape is so strongly marked, that persons of experienee are able to distinguish from what growth of vine the brandy has been manufactured.

The best brandies are those whieh are imported from France; and of these the most esteemed are made at Cognae and Armagnae. Next to them rank in quality the brandies of Spain. The purest Freneh brandies are only slightly rectified, and contain more than half their weight of water. This may be explained as follows:—Aromatie liquors lose their peculiar flavour by redistilling. It is only the brandy whieh is obtained from the first distillation that contains the essential oil of the wine, which imparts to it an agree-

able bouquet. This oil is among the substances first volatilized in the operation, and is so easily affected by heat, that, by repeating the process, it becomes destroyed. This is so certain, and the manufacturers are so well aware of it, that when the brandy has been made out of inferior materials, and it is necessary to remove any unpleasant flavour, all that is done is to redistil the spirit to its highest proof.

Although it is only the best kind of brandy that is imported into England, yet the taste and bouquet is generally sacrificed, owing to the prejudice prevalent here for certain flavours; to obtain which, burnt sugar is employed, which destroys all traces of the original odour and taste.

Those wines which have been made from grapes abounding in saccharine matter, which has been completely decomposed during the vinous fermentation, give the best brandies. The softest spirit is procured from white wines. The heavy wines of the south produce an inferior quality of liquor. In a pure state, brandy is of a clear, transparent colour, resembling water in appearance. It owes its pale amber tint to the wood of the oaken cask in which it is kept. The astringent flavour, which some persons so much admire, is also due to the same source.

The characteristics of good brandy, which distinguish it from other ardent spirits in general use, are its cordial and stomachic properties. It is often given medicinally to relieve spasmodic pains and flatulency. In cases of sea-sickness, it is efficacious in checking vomiting. It also gives temporary relief to those suffering from indigestion; and when diluted with hot water, it is an easily obtained remedy for slight cases of diarrhœa, when unaccompanied by local inflammation.

In France, as in England, immense quantities of spirit, sold as brandy, are distilled from corn, sugar, molasses, beet-root, and potatoes, especially from the latter vegetable. The coarseness and bad flavour of

the spirit is much reduced by the careful treatment of the rectification; but, in spite of all precautions, it is impossible to disguise the peculiar taste of the substance from which the brandy has been obtained. Fruits which abound in saccharine matter are also largely employed in the distilleries. These fruits require only to be mashed and mixed with a certain proportion of water, and then allowed to ferment. The produce is a liquor possessing the flavour of the particular fruit; and, according to its distinctive name, so is the brandy called and sold. If the distilling has been carefully conducted, the result is also satisfactory and palatable.

The refuse of the grape, after the juice has been extracted for the purpose of being made into wine, is distinguished by the name of *murk*. However much it may have been submitted to the action of the press, it is always found to contain a certain quantity of undecomposed sugar, besides being impregnated with a small portion of the wine itself. The brandy manufacturer usually takes advantage of these circumstances to obtain from this murk an additional supply of spirit. It is beaten in water, fermented anew, and distilled, and the product sold as the brandy of murk. Sometimes this liquor has a most disagreeable taste, owing to the essential oil contained in the skin of the grape, called fusel oil (see *Gin*), and which is so energetic, that only a few drops will completely taint a pipe of 600 litres of fine-flavoured spirits. The only known means of removing this taste is by redistilling the liquor, and carrying it to the highest degree of rectification.

By the 30th Geo. III., spirit dealers are forbidden from selling brandy, unless it is of a certain strength. The words of the act are as follows:—"No distiller, rectifier, compounder, or dealer shall serve or send out any foreign spirits of a lower strength than that of one in six under hydrometer proof, nor have in his possession any foreign spirits mixed together, except

shrub, cherry or raspberry brandy, of a lower strength than as aforesaid, upon pain of such spirits being forfeited," etc.

Brandy commands so high a price, and so few persons are capable of judging of its good qualities, or detecting its bad, that few spirit merchants are able to resist the strong temptation to increase their profits by adulteration. The brown brandies are those which are most tampered with; for the colouring matter offers both a disguise to taste and appearance, which protects the imposition. The pale brandies sold in this country are mostly corn spirit, coloured and flavoured as closely as possible to resemble the Cognac liquors. Of late, the business of British brandy-making has greatly increased. To those who only judge of the excellence of a brandy by its strength (as is the case in nine instances out of ten), our potato and corn spirits would appear to be a more choice production than the mild aromatic liqueurs of France. The spirit merchant is well aware of this, and profits by the gross error; indeed, on many occasions, he will be complimented on the excellence of the so-called brandies; whereas, if they had in reality been of foreign production, most likely they would not have been approved of, and a customer been lost.

There is a work entitled "A Treatise on Brewing and Distilling" (but which is in reality a guide to adulteration), in which Mr. Shannon, the author, gives the following advice:—"All brandies, whether French, Spanish, or English (being proof goods), will admit of one pint of liquor (water) to each gallon, to be made up and incorporated therewith in your cask for retail, or selling smaller quantities, and all persons that insist upon having proof goods, which not one in twenty understands, you must supply out of what goods are not so reduced, though at a higher price."

A common method of adulterating brandy is by mixing it with the spirit distilled from British mo-

lasses and sugar, and then colouring the compound with burnt sugar. A more elaborate and cunning plan of sophistication is as follows:—The murk, or refuse of the skins and pips of the grape, after the press has been used, is, in France, of a comparatively trifling value. That preserved from the best qualities of grapes serves, as we have before said, for distilling from it an inferior quality of brandy; but, generally, it is only employed as a manure, as food for fowls, or, when dried, as fuel, like the tan in some parts of England. The British brandy-maker buys up this murk, and imports it into this country, paying upon it the same duty as that levied upon wine. By distilling British molasses over these lees, the manufacturer obtains, to some extent, the peculiar flavour which characterises French brandy, and which is owing to a small portion of a peculiar essential oil contained in the husk of the grape, provided the spirit, prior to its being passed over the murk, is deprived of its disagreeable odour and taste by rectification over freshly burnt charcoal and quick lime.

Dr. Ure gives the following formula as one which is employed for converting corn spirit into a factitious brandy. The pure alcohol is diluted to the proof pitch, and to every 100 pounds weight of it half a pound of argol (crude wine-stone) is added, previously dissolved in water. In addition, there must be used a little acetic ether, some French wine vinegar, some bruised French plums, and flower stuff from Cognac (murk). The spirit is then distilled off with a gentle fire, in an alembic furnished with an agitator. The spirit which comes over is coloured, with burnt sugar, to the tint required, and roughened to the taste with a few drops of the tincture of catechu or kino.

As with rum, oak sawdust and a tincture of grape-stones (obtained for the purpose from the murk) are employed to impart to new brandy the taste of a spirit that has been long kept and ripened in an oaken cask. In what are called brown brandies, the colouring

matter is obtained from burnt sugar and molasses, which is supposed by the manufaeturer to give to imitative brandy a luscious taste and fulness in the mouth, that London customers are said to admire.

The author of a work on "Malted and Unmalted Corn eonnected with Brewing and Distilling," gives the following method of concocting a speeies of brandy for retail trade :—

"To ten puncheons of brandy,	1081	gallons,
add flowering raisin spirit -	118	,,
Tincture of grains of paradise -	4	,,
Cherry laurel water - - -	2	,,
Spirit of almoud cake - -	2	,,
	1207	

Add also ten haudfuls of oak sawdust, and give it complexion with burnt sugar."

It is not difficult to discover if what is sold as genuine Freneh brandy has been sophistieated with the spirit of molasses. If a small quantity of the liquor be rubbed between the palms of the hands, the alcohol evaporates, and leaves behind the unpleasant and evideut odour whieh is peculiar to and distinguishes the British spirit.

The value of ardent spirits is supposed to depend upon the quantity of alcohol they contain, and it is in proportion to their strength that the amount of duty is fixed. The method usually adopted consists in determiuing the speeifie gravity of the liquid by means of an instrument called the hydrometer. That which is adopted and employed in this eountry is called Sykes's hydrometer. Alcohol, haviug a speeific gravity of 0·920, at 60° Fahrenheit, is called proof spirit; that which is heavier, or contains more water, is said to be under proof; that whieh is highly rectified, and consequently lighter, is called over proof. Some years ago, the manner of testing the strength of alcohol was excessively crude and inaecurate. Gun-

powder was covered with spirit, which was inflamed, and if at the end of the combustion the powder exploded, the spirit was said to be over proof; but if the alcohol was mixed with much water, and so damped the powder that it did not go off, the spirit was said to be below proof.

"Alcohol," says Dr. Pereira, "is a fuel in the animal economy, by the combustion of which caloric is evolved." Further on he adds, that "though alcohol evolves heat in burning, it is an obnoxious fuel. Its volatility, and the facility with which it permeates membranes and tissues, enables it to be rapidly absorbed; and when it gets into the blood it exerts a most injurious operation, before it is burnt in the lungs, on the brain and the liver."

In the year 1851 the quantity of brandy imported amounted to 938,280 gallons, the duty on which was 15*s.* per imperial proof gallon.

Gin.

This ardent spirit is prepared from the alcohol distilled from a mixture of malt and barley, and flavoured not only with juniper berries, as is commonly believed, but also with sweet flag, cardamoms, grains of paradise, orris root, dried orange-peel, liquorice powder, and a variety of other substances which have aromatic and stimulating properties. The Dutch were the first to make gin. In the large distilleries of Schiedam it is manufactured from unmalted rye and barley malt, and a flavour is imparted to it by the addition of juniper berries.

This spirit is the favourite stimulant of the people of London, who consume it in large quantities. It is generally swallowed in a raw state, by people who enter a public-house, and take a glass whilst standing at the bar.

Taken in moderate quantities, and diluted with

water, pure gin is not an unwholesome stimulant. On account of the oil of juniper which it holds in solution, it is a more powerful diuretic than either brandy or rum. It is often administered by medical men in dropsical and other affections, where an augmentation of the renal secretion is considered desirable.

Accum, Mitchell, Hassall,—all authorities, in fact,—are agreed as to the enormous, and, in some instances, criminal, extent to which the adulteration of gin takes place. "If we examine gin, as retailed," says Accum, "we shall soon be convinced that it is a custom pretty prevalent amongst dealers to weaken this liquor considerably with water, and to sweeten it with sugar. This fraud may be readily detected by evaporating a quantity of the liquor in a table-spoon over a candle to dryness; the sugar will thus be rendered obvious in the form of a gum-like substance, when the spirit is volatilized."

One hundred and twenty gallons of genuine gin so obtained from the wholesale manufacturers are usually made up by fraudulent retailers into a saleable commodity with fourteen gallons of water and twenty-six pounds of sugar. Now this dilution of the liquor produces a turbidness, because the oil of juniper and other flavouring substances which the spirit holds in solution become precipitated by virtue of the water, and thus cause the liquor to assume an opaline colour; and the spirit thus weakened cannot readily be rendered clear again by subsidence. Several expedients are had recourse to to clarify the liquor, some of which are harmless and others criminal, because they render the liquor poisonous.

One of the methods, which is innocent, consists in adding to the weakened liquor, first, a portion of alum dissolved in water, and then a solution of subcarbonate of potash. The whole is stirred together, and left undisturbed for twenty-four hours. A precipitation of alumina is thus produced from the alum, which, as

it slowly desceuds, acts as a strainer upon the milky liquor, and carries down with it the finely divided oily matter which produces the blue colour of the diluted liquor. Alum is also often employed, without any other addition, for clarifying spirituous liquors.

Another method, according to Accum, cousists iu adding first a solution of subacetate of lead, and then a solution of alum. This practice is highly dangerous, because part of the sulphate of lead, which results from the combination of these two chemical substances, remains dissolved in the liquor, which it thus reuders poisonous. Unfortunately, this method of clarifying spirituous liquors is more frequently practised than the prece diug method, because its action is more rapid, and it imparts to the liquor a fine complexion, and great refractive power; hence some vestiges of lead may often be detected in malt spirit. The weakened spirit is then sweetened with sugar, and, to cover the raw taste of the malt spirit, a false strength is given to it with grains of paradise, Guinea pepper, capsicums, and other acrid and aromatic substauces.

The most bulky adulteration of gin is, as with beer, effected by the addition of water. In Shannon's book, "On Brewing aud Distilliug," the following directions are given to the publican:—

"*To reduce Unsweetcned Gin.*

A tun of fine gin	252	gallous
Water	36	„
Which, added together, make...	288	„
The *doctor is now put in* (which means that certain ingredients are added, for imparting an apparent streugth iu the place of that which has suffered by the dilution), and it is further reduced with water.....	19	„
Which gives.....	307	galls. of gin.

"This done, let one pound of alum be just covered with water, and dissolved by boiling; rummage the whole well together, and pour in the alum, and the whole will be fine in a few hours."

To prepare sweetened gin, the same author recommends that, for 120 gallons of clear rectified spirits, a quarter of an ounce of oil of vitriol, half an ounce of oil of almonds, a quarter of an ounce of oil of turpentine, one ounce of oil of juniper berries, half a pint of spirits of wine, and half a pound of lump sugar, should be beaten or rubbed in a mortar. The next additions consist of half a gallon of lime-water and one gallon of water, and the whole is to be mixed in a pail, by means of a stick, until every particle is dissolved. Twenty-five pounds of sugar, liquefied in nine gallons of rain-water, are next added, the whole well mixed together, and carefully stirred with a stick, in a 133-gallon cask.

We should, for curiosity's sake, like to taste the above curious compound; for, from the description, we cannot imagine the kind of flavour the mingling together of vitriol, turpentine, lime and rain water would impart to the 120 gallons of pure gin.

Another plan of restoring to watered gin the taste and inebriating quality of strong spirit, is by using grains of paradise, which have the effect of giving it a hot, pungent flavour. Grains of paradise are the seed of a species of cardamom, greatly esteemed by the natives of the Guinea Coast, who use them for seasoning their food. They are small, and angular in form, about the size of a small shot, and the kernel, which is perfectly white, is enclosed in a reddish husk. They all have a pungent, hot taste, resembling a strong pepper.

The immense quantities of these seeds which are imported into this country are entirely consumed in the adulterations of beer and spirituous liquors. Although a penalty of £200 for each offence is, by Act of Parliament, threatened against all who use grains

of paradise for strengthening malt liquor or spirits, and although no druggist is allowed to sell them for that purpose, under a fine of £500, still, cargoes of them continue to arrive in this country, and druggists continue to sell, and publicans to use them.

Oil of vitriol and oil of almonds are used to adulterate gin, for the purpose of making it bead, which means that, in pouring out the gin, it causes it to form a series of little bubbles, which hang to the sides of the glass, and encircle the liquor. This property of beading is considered by publicans to be most important, for many persons foolishly infer that gin which does so must necessarily be strong and pure.

There are manipulations and tricks in the retail spirit trade which have been made a special subject of study by some authors, who seem to consider publicans to be of so innocent a nature, as to require instruction about the best method of taking care of their own interest. In one of these tavern-keeper's guides we find the following excellent rules laid down for the better deception and treatment of the customer.

"When you are to draw a sample of goods to show a person that has judgment in the proof, do not draw your goods into a phial to be tasted, or make experiment of the strength thereof in that way, because the proof will not hold, except the goods be exceedingly strong; but draw the pattern of the goods either into the glass from the cock, to run very small, or rather, draw off a small quantity into a little pewter pot, and pour it into your glass, extending your pot as high above the glass as you can without wasting it, which makes the goods carry a better head more abundantly than if the same goods were to be put and tried in a phial.

"You must be so prudent as to make a distinction of the persons you have to deal with; what goods you sell to gentlemen for their own use, who require a great deal of attendance, and as much for time of payment, you must take a considerably higher price

than from others; what goods you sell to persons, where you believe there is a manifest, or at least some hazard of your money, you may safely sell for more than common profit; what goods you sell to the poor, especially medicinally (as many of your goods are sanative), be as compassionate as the cases require."

To detect the presence of capsicum, grains of paradise, etc., the suspected spirit should be evaporated to dryness in a water-bath, which means, that a cup filled with the gin should be floated on and kept in boiling water, so that the heat may never exceed 212°. The residual matter left, after the evaporating process, will be found to taste of the substances in question in proportion to the quantity present.

To discover the quantity of sugar which has been employed in the adulteration and sweetening of gin, it is only necessary to evaporate the spirit gently, when the saccharine matter will be left in a crystallized form, and its amount can be easily ascertained.

According to Dr. Muspratt, sulphuric acid is largely used in the gin concocted for the mining districts. It is not difficult to detect its presence. A small portion of this liquor need only be evaporated on the hob of a fire-place, and if this acid has been present in any quantity, it will, as soon as the spirit and water has been driven off, at once attack the sugar employed for sweetening, and convert it into a black mass of charcoal.

Dr. Letheby analysed a sample of Plymouth gin, and found that it did not contain more than 29·2 per cent. of alcohol (that obtained direct from the distillery usually having from 40 to 48 per cent.) It had only a mere flavour of juniper or any other flavouring agent, was free from sugar, and there was present in it sulphuric acid in combination.

Dr. Hassall, on the authority of a gin distiller, states that the practice of adding sulphate of zinc, or, as it is commonly called, white vitriol, to gin is very common. This may be tested by taking a portion of

the syrup obtained by gentle evaporation, and treating it with sulphuretted hydrogen gas, which will precipitate the zinc in the form of a white hydrated sulphuret.

Of course, the adulteration of gin with obnoxious substances takes place at the public-houses, and not at the distilleries. Whenever we have examined any samples that have come direct from the manufacturer, we have invariably found them to be perfectly pure, and free from any additions but those necessary for giving the liquor the necessary flavour. To use the words of one of our largest distillers:—

"The utmost precautions are taken to obtain from distillation a result favourable to the public health.

"Medical study is brought to bear on the question, and the chemical action produced in rectifying the malt spirit is most exactly adapted to the object, of withdrawing all impurity, without communicating any injurious agency.

"In the operation of flavouring, the Dispensatory of Dr. * * * is consulted, both as to the virtues of the materials and the quantities that should be used. So with regard to the various cordials and liqueurs we produce; we study to combine materials favourable to health. When any ill effects result from their use, the fault lies with those who take them in excess."

In the London public-houses, the form of adulteration principally employed is, by adding large quantities of water and sugar. In the lowest neighbourhoods, the gin is so extensively diluted, that Cayenne pepper is extensively employed to give it an apparent strength.

Although the attention of the Excise authorities has, during an indefinite period, been repeatedly called to the horrible adulterations of gin, which are so commonly and almost openly practised, although it would seem that the revenue is defrauded, and the health of a large proportion of the population seriously injured, yet they almost refuse to take notice of these

adulterations, even when the most simple means of detecting them have been pointed out. This is no question of the appointment of a public inspector; all that is wanted is to have Excise officers who understand the interests of the Excise, and who are capable of performing their own duties.

"The introduction into the stomach of raw spirits is sufficiently destructive to health of itself," says the *Lancet;* "but the addition of such powerful and acrid substances as Cayenne and grains of paradise to spirit forms a compound which no human stomach or system, however strong, can long withstand."

Much of the gin sold in London is also very injurious, from the fact of it not having been properly purified, and from containing a peculiar volatile oil, termed fusel oil. Dr. Ure states that it is most frequently to be met with in the alcohol distilled from the damaged grain which abounds after a moist autumn. "*Such spirits intoxicate more strongly than pure spirits of the same strength, and excite in many persons even temporary frenzy.*" The spirit which contains this fusel oil is always more or less opalescent, or becomes so on dilution by water, and then throws up an oily pellicle upon its surface. At the end of a few months this oil spontaneously decomposes the spirits which contain it, and leaves them in a less nauseous and noxious state.

Fusel oil is a colourless, fatty fluid, lighter than water, of a very offensive odour. It coagulates albumen and casein, and appears to soften and dissolve the lining membrane of the alimentary canal. Although a poison, it does not appear to be a very energetic one. Dr. Taylor states that two drachms of it killed a rabbit in about two hours. The principal symptoms were depression and difficulty of breathing. Three drachms killed a rabbit in one hour, half an ounce caused death in a quarter of an hour, and one ounce in four minutes. It appears to have at first a stimulating and afterwards a depressing action. "In

small quantities," Dr. Taylor remarks, "it produces intoxication. I have experienced the effects of the vapour, and found them to be giddiness, accompanied with a feeling of suffocation, and a sense of falling. Headache followed, which lasted for half an hour."

The charcoals of light wood, such as pine or willow, well calcined, and infused in sufficient quantity with the spirit prior to rectification, will deprive it of the greater part of this oily contamination; but the gin would then lose its valuable property of "intoxicating more strongly than pure spirits of the same strength," and of "exciting in many persons even temporary frenzy."

Rum.

Rum is a spirituous liquor obtained, both in the East and West Indies, by distillation from the fermented juices of the sugar-cane, or from molasses. The skimmings of the sugar-boiler are also employed for producing an inferior quality of spirit, as well as the washings of the boiler, and what is distinguished as *dunder*, or the lees of former distillations. During the distillation of this spirit, there passes over a small proportion of a peculiar volatile oil, obtained from the sugar or molasses, which imparts to the rum its peculiar odour and flavour. The ordinary proportion of alcohol present in this liquor differs from 50 to 56 per cent.

Rum is imported into this kingdom in puncheons, and is entirely the produce of the West Indies and, to a great extent, of Jamaica. In the year 1851, the quantity entered at the Docks amounted to 4,747,031 gallons, of which nearly three millions were consumed, returning a duty of £1,098,200. Perhaps the reason why the consumption thus appears to be so far below the imports, may be accounted for by the fact that rum is the liquor used in Her Majesty's navy, and the large quantities required for the service would, of

course, pay no duty, and therefore not be mentioned in the Excise returns.

In some parts of Jamaica the manufacturers impart an artificial flavour to rum by putting slices of pine-apple into the puncheons. Such spirit is known to the trade as "Pine-apple Rum." Of late a means has been discovered of giving the liquor the same taste, by mixing with it a few drops of a substance chemically prepared, by combining amylic or potato ether with butyric acid, and then dissolving it in alcohol. It may also be obtained by making butter in a mass, and then distilling it with sulphuric acid and alcohol. It has a pleasant flavour, closely resembling that of pine-apples, and is used for flavouring sweetmeats and, to a great extent, in giving to bad rum the odour and taste of that which has been prepared with the utmost care in Jamaica.

Rum has nearly the same effects upon the human body as brandy, but it is considered to be more heating, and to cause perspiration more than any other kind of spirit. For this reason, those afflicted with colds and coughs, or rheumatism, generally prefer its use. It is curious that many, who take it in this medicinal sense, assert that its effects are increased by dissolving a small portion of butter in the hot water solution. As the pine-apple flavour is manufactured out of butyric acid, most likely the flavour is augmented by this addition. Sir Hans Sloane, in his "Jamaica," writes, "They talk of a common experiment here (Jamaica), that any animal's liver put into rum becomes soft, and not so in brandy, whence they argue this last is less wholesome than that; but their experiment, if true, proves no such thing. I think it may be said to have all the good and bad qualities of brandy, or any fermented or vinous spirit."

In cases of extreme suffering and exhaustion, as Dr. Pereira informs us, as also when the strength is prostrated, either from excessive exertion or privation of food, the cautious and moderate use of spirit has,

on many occasions, proved invaluable. In Captain Bligh's account of the mutiny of the Bounty, and the sufferings he and his companions had to endure, he says, "The little rum we had was of great service. When our nights were particularly distressing, I generally served a teaspoonful or two to each person; and it was joyful news when they heard of my intentions."

Like other alcoholic drink, rum is adulterated, and with nearly the same materials. That sold at the public-house seldom contains more than 20 per cent. of alcohol, owing to the great quantities of water with which the imported liquor is mixed. Burnt sugar and molasses are also added, to restore the colour and sweetness, and cayenne and cocculus Indicus are used to give an imitation of strength and genuineness. One of the few known cases where death occurred through poisoning with cocculus Indicus was when it had been employed for adulterating rum. Several sailors at Liverpool drank a glass each of this spirit, which had been sophisticated with this berry. One died in the course of the evening, but the others ultimately recovered.

Cocculus Indicus contains from 1 to 2 per cent. of a poisonous alkaloid, called picrotoxia. When a decoction is made from these berries, it will, if taken internally, give rise to nausea, vomiting, and griping pains, followed by stupor and intoxication. It is therefore to impart a stupifying and intoxicating quality to rum diluted with water that the publican employs this drug. As we have before noticed, this substance is applied to no useful purpose whatever, either in medicine or the arts. It is chiefly used for the purpose of adulterating beer and spirits, and its importation, it is useless to add, should consequently be strictly forbidden.

To give new rum the same apparent flavour as old, oak sawdust and a spirituous tincture of the raisin stones are used. The spirit thus treated has a ripe

taste, similar to that which has been long kept in an oaken cask.

New rum, as it is manufactured in Jamaica and the West Indies, often contains lead, derived from the worm of the still, and those who drink frequently suffer from pains in the stomach, and exhibit all the symptoms of lead-colic. On the other hand, old rum is a wholesome drink, and consequently more esteemed. The following explanations have been given by Dr. Traill, of these different conditions of old and new rum. He found that the spirit received in glass bottles from the still always contained lead, but after it had been kept in an oaken cask, the tannin of the wood is gradually extracted by the spirit, and precipitates the lead in an insoluble form, and so purifies and renders wholesome the spirit.

Many persons, who have discovered lead in rum, have wrongfully accused the dealers of being the cause. The explanation given by Dr. Traill at once puts this question at rest.

Whiskey.

This well-known ardent spirit is obtained by the distillation of fermented grain. In most of its properties it agrees with gin, but its smoky flavour and odour are its peculiar characteristics, which it acquires from the malt being dried over turf fires. Many persons judge of the quality of whiskey by its smell of burned turf, or, as it is called in Scotland, *peat-reek;* but of late years this test has lost its value, for bad raw-grain whiskey may be and is artificially impregnated with the taste and smell of peat smoke.

The peculiar flavour of whiskey is, as in other alcoholic drinks, owing to a volatile oil, which is distilled over with the spirit, and obtained from the barley out of which it is manufactured.

In the operation of manufacturing whiskey, the

great object of the distiller is to obtain the largest possible quantity of spirit from his grain; he therefore does not, like the brewer, check the fermentation of the wort (see *Beer*), but allows it to proceed until the whole of the sugar has been converted into alcohol. In manufacturing beer, one-fourth and occasionally—as in our sweet ales—one-half of the sugar is allowed to remain unchanged in the liquor, in order to give it a pleasant taste, and to preserve it in the cask. But, in manufacturing whiskey, to allow any of the saccharine to remain unchanged is to suffer so much loss of spirit. The exercise of judgment requisite for obtaining this result is very great, and upon it depends, in a great measure, the profitable success of the distilling operations. It is calculated that, upon the average, a bushel of malt will yield two gallons of spirit.

Almost all the whiskey consumed in England is manufactured either in Ireland or Scotland. The Irish whiskey is of a darker colour than the Scotch, because it is customary to keep it in a sherry cask for some time, to give it a soft and ripe flavour. In Scotland, however, whiskey is not unfrequently met with that has been coloured by the oaken staves of the barrel; and indeed, in many parts, it is considered to be a proof of the age of the liquor, if it is of a dark tranparent hue. In both these countries whiskey may be considered to be the national drink, in the same way as beer is with us.

One of the adulterations practised on whiskey takes place during its manufacture. Good spirit should be obtained from malted barley only. The distiller, however, to increase his profits, will often mix with the malt a quantity of raw grain and potato starch. The spirit obtained in this way has a harsh and disagreeable flavour, probably owing to the presence of a volatile spirit called amyle alcohol, which is obtained during distillation from the potato.

In the hands of the retailer whiskey suffers the usual

adulterations of water, to increase the bulk, and of capsicum and grains of paradise, to restore the strength.

WINE.

In writing on this subject, we shall only treat of such as is obtained from the grape, and entirely leave out those wines which are manufactured from the juices of fruits, or from the decoctions of certain substances, such as ginger.

Wine is the fermented juice—or, as it is called—must of the grape. When the juice of the grape has been expressed, it will, if placed in a heated atmosphere, readily ferment and become wine. The peculiar qualities and characteristics of different wines are dependent upon various circumstances; such as the country where the vine is grown, the variety to which it belonged, the season at which the fruit was gathered, and the method of pressing out the juice.

The largest wine-producing country in the world is France. It is stated that upwards of one thousand different varieties of the vine are cultivated in its departments. With the exception of a small portion of its vast territory (six northern departments), the land is covered with vineyards. Spain takes rank next to France for the quantity, and Germany for the quality of the wines they produce. The grape is successfully and extensively cultivated in Portugal and in the island of Madeira; but, owing to the little care bestowed upon the manufacturing of the wines, few of them are favourably known in foreign countries. Italy, despite its congenial climate, does not take a high position among wine countries. Most of that which it produces is for home consumption. It is asserted by many that the soil is too rich; and there appears to be a great deal of truth in this; for the most noted wines are those obtained from the vine-

yards planted on the poor land covered with volcanic remains, in the neighbourhood of Naples.

The vine will flourish in any soil that is drained, either by artificial means or by natural position. The sides of mountains, where the ground is covered with stones, produce some of the most celebrated wines. A good rich soil does not favour the vineyard, but rather the contrary; and the lighter and drier the land, the better for the cultivator. Porous soils, particularly those which are chalky, produce the best growths. Volcanic remains, ground composed of decomposing granite, earth which, from its lightness and dryness, is scarcely fitted for any other culture, these are best adapted for nourishing grapes intended for wine-making. The vines grow slowly, but in three or four years, when the roots have taken a strong hold, they flourish luxuriantly, and produce abundantly. Clay, mingled with quartz, or marl, mixed with pebbles or sand, is highly favourable. Animal manure is very seldom used. In France and in Madeira, the growers plant lupines among the vines, and bury them at their feet every second year. Some vines will bear well for sixty years.

All wines have a distinguishing odour, called its bouquet; it is perceived on drawing the cask of any of the finer wines, and on exposure to the air. This aromatic smell depends upon the presence of some volatile principle generated during the fermentation. When the murk or lees of wine are distilled, a liquor is obtained, which has an oily consistence, an aromatic, strong, vinous odour, and a bitterish, disagreeable taste.

The wines of warm countries possess very little smell; those produced in the central departments of France have it in a marked degree; whilst the wines of the still more northerly situated Germany have the most intense perfume. The grapes which are gathered before they are completely ripe have the strongest bouquet.

Wines may be divided into two classes, the white and the red. But they may also be distinguished one from another as strong and light wines. The strength depends upon the amount of alcohol the liquor contains. The strong wines are obtained from grapes grown in the south, where they ripen thoroughly, and are more saccharine, for the sugar which they contain is, during the process of fermentation, converted into alcohol.

The following table will give the reader some idea of the average quantity of alcohol contained in the wines commonly used in England.

	Average amount of Alcohol per cent. by measure	Average amount of Alcohol per cent. by weight.
	Brande.	Christison.
Marsala	25	...
Port	23	14 to 17
Madeira	22	14 to 17
Cape	20	...
Sherry	19	13 to 16
Amontillado	12	...
Constantia	18 to 20	...
Malaga	18	...
Bucellas	18	...
Hermitage, White	17	...
„ Red	12	...
Claret	15	7 to 8
Malmsey	16	12
Sauterne	15	...
Burgundy	14	...
Tent	13	...
Hock	12	...
Champagne	12	...
Vin de Grave	13	...
Côte Rôtie	12	...
Tokay	10	...

That the reader may be able to form from this table some rapid idea of the alcoholic strength of the

different wines, we may add, that brandy, rum, gin, and whiskey contain from 53 to 57 per cent., and the strongest Burton ale not more than 8 per eent. of spirit. It at first appears somewhat startling that port and Marsala should be nearly half as strong as brandy, but such is the ease. But we must remember that the intoxieating influence of wine is not equal to a mixture of spirit and water in eorresponding strength, nor proportionate, in different wines, to the relative quantities of alcohol they contain. It is a matter of evident certainty that a pint of brandy possesses more intoxicating powers than two pints of port. The spirit in the wine seems to have undergone some peeuliar combination with the other liquid particles, which modifies its effeets, and renders it less active than a similar quantity taken by itself. Old wines are less inebriating than new ones, both because a portion of the spirit has evaporated from the cork, and also because the ehemical eombination of the aleohol and the water has become perfeeted, and its activity consequently lessened. In most wines, the quantity of aleohol is decreased by keeping, but Madeira and sherry form an exeeption; and, for the first five or six years, rather inerease in strength, owing to the sugar they contain becoming slowly eonverted into spirit.

Many wines are what are called sweet wines, from the quantity of sugar they hold in solution. Sueh, for instance, are Tokay, tent, Frontignae, and malmscy. To make them, the grape is allowed to ripen to the fullest extent, until they are almost shrivelled up to raisins, and have the greatest quantity of saccharine: In making the wine, the fermentation is arrested before all the sugar is converted into alcohol.

Other wines are known as dry wines, as some kinds of sherry. To attain this objeet, the fermentation is eneouraged and lengthened, until all the sugar has disappeared. Some wines, such as port, obtain, when kept for any time, a tawny flavour, which many persons greatly admire. This roughness or astringency

is said to be due to the presence of a small quantity of tannic acid, derived from the husks and seeds (murk) of the grape, during the process of manufacture; or, as is highly probable, extracted from the staves of the casks in which it is exported abroad.

The colouring matter of the grape is resident in the husk. For the preparation of what are called white wines, the juice of the fruit is expressed and fermented by itself; but for obtaining the dark wines, the husks are allowed to remain during the fermentation, and so give a red hue to the liquor.

Port Wine. — This is a Portuguese wine, much esteemed in this country, and consumed in such large quantities, that two-thirds of the year's produce of the vineyards are imported into England. Extremely high prices, sometimes as much as eighteen shillings a bottle, are given for fine specimens of this stimulating drink.

The vineyards of the Douro, from which port wine is manufactured, extend for upwards of forty miles along the banks of that river. The sloping banks, the peculiar soil, and the hot sun are all most favourable to the cultivation. Little or no care is shown in choosing the best description of grape for making this wine; every variety is indiscriminately employed and mingled together, and the flavour consequently depends upon whichever species of fruit happens to preponderate in quantity or fulness of flavour. The vine which is usually considered to be the best adapted for making the wine, is that which produces the greatest crop of black fruit.

The manufacturing process consists in placing the grapes in vats and treading out the juice, and even after fermentation has commenced this operation is continued. Although the wines of the south naturally contain large quantities of alcohol, yet during the fermentation brandy is added, often to the extent of twelve gallons to the pipe. The injury thus done to the must is excessive. The spirit never properly

combines with the wine, and is consequently overcharged with alcohol, which, of course, utterly destroys the flavour, and is most injurious to the health. When the colour of the skin of the grape is not deemed sufficiently dark to give the wine a rich, deep tint, elder-berry colouring is added, and with it four more gallons of spirit. It was a common practice to grow elder-berry trees in the vineyards. Other proprietors purchase them; indeed, it is stated that one of them expended no less a sum than £400 every year for that purpose. Before the wine is shipped to England, more brandy is added, and also a peculiar mixture called *geropiga*, which adulterating compound consists of dried elder-berries, coarse brown sugar, and treacle, unfermented grape-juice and strong brandy. Logwood is also imported in large quantities into Oporto, although there is no well-authenticated employment for such large shipments; unless they are used for sophisticating purposes.

Why this practice of adding brandy to port wine should be permitted it is impossible to imagine. The coarsest spirit, such as that made from figs, is used for the purpose. The absurdity of the custom is so apparent, that it is difficult to imagine what motive could prompt it; for its only effect is to spoil the bouquet and peculiar taste of the wine, and to restrict its consumption, through rendering its inebriating powers so great, that, instead of being taken as a drink, it can only be employed as a cordial. Some assert, and with much apparent justice, that the spirit is added for the purpose of giving a uniform taste to all port wines. The excuse that the brandy is necessary, to enable the port to support the sea voyage without injury, is absurd; since champagne, a light wine, which contains infinitely less alcohol, may be sent to America, without being in the least affected by the transit.

A large adulteration is carried on at Oporto, by mixing port with inferior wines, which are imported

for the express purpose. By this method the supply of port wine is always kept up to a uniform quantity, however bad the year's vintage may have been.

No article of commerce is so much adulterated as port wine. Every trick has been employed, every ingenuity exercised to deceive the purchaser. As the knowledge of the proper flavour of wines forms in itself an art which few excel in, and all are ambitious of, the unprincipled merchant has a wide and safe field for his nefarious practices. For the purpose of increasing the brilliancy of the colour of young and thin wines, alum is added in small quantities. Despite the copious dose of elder-berries given to port in Portugal, for imparting to it a rich deep tint, it no sooner arrives in England, than it is subjected to a further addition. To make cloudy wine clear and transparent, gypsum is the favourite remedy, and additional astringency is imparted by oak-sawdust, obtained from brewers' chemists and shipbuilders' yards, and the husks of filberts. Various expedients are resorted to for the purpose of giving peculiar "bouquets." Port is sophisticated with extracts of sweetbriar, orris root, clary, cherry laurel water, and elder-berry flowers.

Spoiled cider is bought up throughout the country, for the purpose of being manufactured into an imitation of port. The business of imitating wines is not only in London but also in many continental towns a distinct and lucrative occupation. At Cette, in France, those following this trade do not hesitate to fasten boards, with "Wines manufactured here," over their doors. Large shipments of spurious port arrive from this town, most of which do not contain one drop of the real wine. To imitate the appearance of age, white wines are not unfrequently mixed with the red kind, but the crust which they deposit is never good or firm. Again, new port is put into warm water, which is urged to the boiling point, and then the wine is put back into the cellar, and deposits a

crust, which at the first glance has the appearance of the growth of years.

In a work entitled "Wine and Spirit Adulterations Unmasked," an attempt is made to expose a portion of the roguery practised by the trade. It states that large vats are kept by the manufacturers, in which they mingle the different wines which are afterwards to be retailed as genuine port. Beni Carlos, which may be purchased, duty included, at £38 a pipe, Figueras at £45, red Cape at £32, and a pipe or two of common port, are to be mixed together, and a small quantity of mountain added, to impart a softness, and give a rich appearance. Salt of tartar will ensure a quick and firm crust, and gum dragon give a fulness of flavour, a consistency of body, and a good face. Berry-dye, a colouring matter imported from Germany, for the express purpose of adulteration, will increase the deep purple tint. With the washings of brandy casks the whole compound is made perfect. "Thus, then," says the author, "we have eight pipes of superior port wine, made up according to the best and most approved plan, and which stands advertising dealers at £50 per pipe of 115 imperial gallons, every expense included, and reckoned at the very outside. The wine thus made up, if drawn off in bottles of the size of sixteen to the gallon, old measure, and adding a charge of 6*d*. per dozen extra for corks, would cost only 16*s*. 9*d*. per dozen."

In a work entitled the "Publican's Guide," the author recommends port wine to be made after the following receipt:—The cask is first to be well sulphured, and then twelve gallons of strong port, three gallons of Cognac brandy, and six of proof spirits of wine, forty-two of good rough cider, making in all a compound, at the rate of 18*s*. a dozen, Another plan is to take forty-five gallons of cider, six of brandy, two of a decoction of sloes, and eight of port wine. To increase the colour, tincture of red sanders must be added. This is to be bottled in a few days, and

a teaspoonful of powdered catechu added to each, to give a rough flavour, and ensure a fine crust on the bottles. The cunning of the trade is excessive; for, to complete the imposition, and give even the corks an appearance of age, their ends are to be soaked in a strong decoction of Brazil wood and a little alum.

In Dr. Reece's "Gazette of Health," the following receipt is given for manufacturing a port wine :—"Take of British grape wine, or cider, four gallons, of the juice of red beet-root two quarts, of brandy two quarts, of logwood four ounces, of rhatany root, bruised, half a pound. First infuse the logwood and rhatany root in brandy and a gallon of grape wine or cider for a week. Then strain off the liquor, and mix it well with the ingredients. Keep it in cask for a month, when it will be fit to bottle."

The peculiar flavour is often given to factitious port by means of tincture made from the seeds of the grape, which are found in such large quantities in the murk, after pressing out the juice, that, in France, chickens are fed with them.

Tartar is a salt which exists in the juice of the grape, and owing to its insolubility, it is deposited during the fermentation, in the form of small crystals, and is found incrusted on the sides and bottom of the casks. It gives no taste, neither does it assist in brightening the wine; but it is simply a sign of its purity and excellence. Of course, the factitious port manufacturers have not allowed so important a criterion of a wine's goodness to pass by unimitated. A hot saturated solution of tartrate of potash, coloured red with a decoction of Brazil wood, is placed in the cask, which is rolled about so that all the sides may be covered with it, and then suffered to crystallize; after this imitation of maturity, the compound called port wine is poured in. The interior of empty bottle are treated in the same manner.

It is asserted by some that wine is sometimes adulterated with lead, for the purpose of staying any

tendency to turn sour. Dr. Watson asserts that this practice is largely followed in Paris; and Dr. Warren gives an instance where thirty persons, who partook of such wine, were all seized with pains in the stomach, and sickness.

There is a treatise on wine-making, by a Mr. Graham, where, under the head of "secrets," he says, "to hinder wine from turning sour, put a pound of melted lead, in fair water, into your cask, pretty warm, and stop it close." Another receipt for softening grey wine is to put vinegar into the cask—"vinegar wherein litharge has been well steeped."

Wine adulterated with lead is easily detected, by throwing sulphate of potash, or liver of sulphur, as it is called, into it, when a black precipitate takes place.

Professor Taylor says that the presence of lead in wine may be accounted for by the lead shot, which are used for the purpose of cleaning the bottles, being frequently left in them. He has found when the shot are in much larger proportion *than could ever be left by accident in a wine bottle*, that good wine, whether port or sherry, becomes only very slowly impregnated with lead. After two or three months a white sediment was formed, but no lead was dissolved. After thirteen months the port wine retained its colour, and scarcely any portion of lead was dissolved by it. The sherry had become darker in colour, and the presence of lead was very evident in it. After a lapse of six years the port wine had a dull red colour, and when tested, gave only faint traces of lead; but the sherry had acquired a very pale straw colour, and was pretty strongly impregnated with lead. Very acid wines dissolve the lead more rapidly, and in a quantity sufficient to produce colic, or other serious symptoms.

A long use of such wines, although each bottle may contain but a very small portion of lead, is extremely dangerous, and certain to lead to serious consequences. If even the repeated application of a hair dye, which consisted of lead and lime, caused, as mentioned by

Dr. Brück, of Hanover, a violent ophthalmia, what should be the effect of repeated and regular doses of wine poisoned with this metal, when taken internally.

Dr. Vogel has recommended acetate of lead as a test for detecting extraneous colouring matter in wine. He states that when genuine red wine is mixed with this salt, a greenish grey precipitate takes place; but that if the wine has been coloured with logwood, elder-berries, or bilberries, it gives, when tested with acetate of lead, a deep blue precipitate; whilst that which is thrown down, when beet-root or Brazil wood has been employed, is of a dark red colour. He proved the truth of this test by experimenting upon a variety of wines, whose genuineness could not be disputed, and in each instance the precipitate obtained with acetate of lead was of a greyish-green colour. Further, to assure himself, he prepared a quantity of grape-skins, and reduced them to powder. In this condition they communicated to alcohol a deep red colour (as they do to wine, for the colouring matter resides in the skin of the grape, and is extracted during fermentation, when alcohol is being formed). When this tincture was treated with acetate of lead, the same greyish-green precipitate was obtained. After such conclusive experiments, we are surprised that so simple a test is not more extensively used.

Sherry.—This wine is made in Andalusia, near Cadiz, in Spain. The better qualities are produced at the eastern extremity of the province of Cadiz, in the vineyards which surround the town of Xeres de la Frontera, for which reason the wine is called the wine of Xeres, or, as the English call it, sherry. The vineyards from which the British market is supplied occupy an immense space of land—upwards of eighty thousand acres. Of all kinds of sherries, including those of Xeres, Teneriffe, Malaga, Ximenes, and others, nearly half a million of pipes are made, of which the greater quantity, to the value of £450,000, are exported abroad.

The vineyards of Xeres are principally situated on slopes or declivities. The soil is chalky, mingled with sand and an ochreous earth, with, in some places, clay. The vines are extremely productive, the average vintage being about three hundred gallons the acre; but occasionally as many as six hundred have been obtained. The vines are planted far apart from each other, and the earth is dug deep and trenched, but never manured. About January the ground is dug up and weeded, and in March, when the shoots of the vines are pushing forth, they are pruned. The labour bestowed upon the trees is very great. Insects are hunted for and destroyed, the earth is constantly raked, and the branches, heavy with grapes, are propped up; so that the high price of sherry may, in a great measure, be accounted for by the expense of cultivation.

The varieties of sherries depend upon the nature of the soil that nourishes the vine, also upon the species of the vine, and greatly upon the fermenting process.

The grapes, which are white, are not gathered until they are very ripe, and shrivelled with the heat of the sun. Sometimes the fruit is, after picking, placed on mats in the sun for a day or two, and the better grapes only selected for making the superior wine. The care taken is very great, owing, no doubt, to the fact that most of the vineyards are leased to the agents or principals of foreign houses, who reside on the spot, and superintend the manufacture of the sherries.

In making the wine, the must or juice is left to ferment, until all the saccharine has been completely changed. Very often the liquid is not drawn off until four or five months after the fermentation has commenced. The colour of the wine is at first a pale straw, but with age it darkens, or a peculiar substance called arropé is added to it, to increase the hue. This substance is obtained by boiling down sherry to about one-sixth of its original volume, until it is transformed into a thick syrup. By the addition of it the dark

sherries, which in England are much esteemed, are manufactured.

The celebrated Amontillado, the driest of all sherries, is not a wine made by any peculiar method or design, but is an accidental result. In attempting to make it, the fruit is plucked at a much earlier period, and trodden down by the peasants; but, strange as it may appear, out of a hundred butts of wine made by the same process, from the same vineyard, some will be Amontillado, and others the regular sherry.

Before sherry is shipped for England, brandy is usually added to it; but there is no reason why this absurdity should be indulged in, unless it is to spoil the natural flavour of the wine, for the same wine, un-brandied, is, without suffering by the voyage, frequently sent to America.

In London, the wine merchants distinguish five kinds of sherries—the very pale, the pale, golden, brown, and very brown. A short time since a fashion set in for very pale sherries, and the wine-growers, to meet the demand, plucked the fruit before it was ripe, and of course a different species of wine resulted. The inferior quality of sherry thus produced caused the taste to run to the other extreme, and very dark sherries became popular. Colour is no criterion of good sherry; the deep tints are artificially procured, whilst the natural hue varies from that of a pale straw to a deep gold.

Like port, sherry commands too high a price for it to escape the adulterating tricks of trade. The profit of substituting a cheap imitation for the genuine Spanish produce is so tempting, that every species of fraud is imagined and practised. Either wine of an inferior quality and value is fraudulently mixed with that which is of really good growth, and, under cover of bills of lading and sale, passed off for what it is not, or else a fictitious compound, in many instances not containing any grape-juice at all in its composition, is unblushingly sold as the genuine wine of Spain.

The adulterations never take place in the cellars of the grower, but generally in those of the exporter, or after they have been landed in this country,—no wine ever reaching England without its flavour having been impaired by additions of brandy. The most delicate sherries are spoiled by the spirit which is poured into the cask, before they are permitted to leave their native land. At Cette, in France, great quantities of sherries are made up and shipped for the English market, the composition of which is nothing more than a cheap white wine, strengthened with brandy, coloured with treacle, and flavoured with almonds. A kind of sherry is manufactured in this country, the basis of which is pale malt and sugar-candy, a small quantity of French brandy and inferior wine being added to flavour the mixture.

Low-priced sherries, may be purchased in Spain at about £18 the butt, and without any attempt at concealing the object for which they are required, are shipped for England. As soon as they arrive at their destination, they are mingled with Cape wine, cheap brandy, or the washings of the casks, sugar-candy, and bitter almonds. The softness of good sherry is closely imitated, and the colour, if necessary, increased or diminished. The whole is allowed to remain in a large vat, until the particles are well mixed, and is then retailed in bottles, fifteen to the dozen, and impudently styled genuine sherry wine.

It is said that muddy wine is quickly rendered transparent by the addition of lead. There is no other known method of rapidly restoring ropy wines, or those which present a milky appearance. The proper remedy is by shaking the wine up with cream of tartar, and allowing it to right itself; but this is, of course, a work of time, and unfortunately does not agree with the adulterating wine merchant's notions of business, so that, although we have already (see *Port*) shown the extreme danger of the practice, lead

is had recourse to, and the health of the consumer jeopardised, and sometimes sacrificed.

Pure pale sherry is generally considered to be the most wholesome of all wines, on account of its freedom from acid, sugar, colouring matter, and extractive matter. It is therefore the least injurious to persons who have a gouty tendency, or suffer from acidity of the stomach.

Madeira.—This wine is grown and manufactured on the island whose name it bears. All the Madeira wine of the first class is produced on the south side of the island; indeed, in the market, the merchants distinguished the different qualities as south and north wines, the former being three times more valuable than the latter.

A great many varieties of grapes are grown on the island, of which few, if any, are indigenous to the soil, but have been brought from Spain and Portugal. The steep hills and gradual slopes which cover the land are excessively propitious to the cultivation of the vine; and the soil, in some parts of a volcanic nature, and in others composed of a sandy red earth, seems to combine all the requisites for vineyard culture.

The method employed in planting out the vine is to place them in parallel lines; but they are also trained in front of the houses on tall trellis work, and the branches made to form a kind of arbour, whose roof of foliage affords a pleasant shade and protection against the fierce rays of the sun.

The methods employed for expressing the juice or must are various. The better qualities of wine are obtained, so it is said, by the fruit being trampled upon, and, after the liquid has been drawn off, a second quality of wine is procured by a further pressure of the murk in a press. The period allowed for fermentation is usually six weeks, and whilst it proceeds the juice is constantly agitated. Heat and motion appear to be the most effective agents for the improvement

of Madeira wine. The growers mellow or ripen their wines by keeping them in stores heated to about 90° Fahrenheit, and this process is said to give them the same qualities as if they had been kept for six or seven years. Others place the bottles, well corked, in heaps of fermenting manure, and this is also stated to give them a mellowness equal to that of several years. The usual method of improving Madeira is by sending it a voyage to the East Indies, and by the heat of the climate and the tossing of the vessel it attains its utmost excellence. To show that any kind of agitation and warmth will answer the purpose equally well, an experiment has been made of attaching a cask of new wine to the beam of a steam-engine, and it was found that in one year, the warmth caused by the fires, and the regular and constant action of the machinery, had produced the same improving results as if the wine had made the journey to the West Indies.

In purchasing Madeira, none but merchants of well-established respectability should be treated with. An advanced price is often exacted from the buyer, on the ground that the wine has made the West Indian voyage. To strengthen the deceit, casks are disguised, and bills of freight shown as proofs of the assertion. Even in the island of Madeira itself, no great reliance can be placed upon the word of the dealer, for wines of an inferior quality are commonly mixed together, and then sold as those of a "first-rate growth;" indeed, the only safeguard against the imposition is by the judgment of the palate, which requires almost an education to attain it. Many imagine that wines purchased at the Docks *must* be pure and genuine, but this is a popular fallacy; for the crafty importer, in general, orders his ships, on their way to England, to touch at Guernsey or Jersey, where the required adulterations are practised, and the cargo is then reshipped and landed at the London Docks, with all the appearance of being genuine and unsophisticated merchandise.

The deceits practised in Madeira are very similar to those to which sherry is subjected. Sometimes the so-called "finest old West India" has been wholly manufactured in England, and has not a drop of Madeira in its composition. For instance, there is a canary wine called Vidonia, which somewhat resembles Madeira, and, like it, possesses the peculiarity of being improved by agitation and heat. This Vidonia is mixed with a small portion of mountain, port, and Cape, sweetened with sugar-candy and flavoured with bitter almonds, and having been subjected to a hot-water process, to give it mellowness and age, is sold at high prices as the finest Malvasia Madeira.

Out of 25,000 pipes of Madeira produced in that island, not more than three thousand belong to the first quality of growth, and of this small number, more than half is brought up for other countries. Indeed, one entire species, the very best, never comes to England at all, but is entirely reserved for the use of the King of Portugal. This will give the reader some notion of the extreme scarcity of the best Madeira, and no doubt convince him that, of the immense quantity annually sold in England as the very finest grown on the island, by far the greater proportion must be either of an inferior character of wine, or else a manufactured imitation.

Champagne.—This much-esteemed and costly wine, which has been called after the province in which it is grown and manufactured, is ranked as the best of the numerous exquisite productions of the French vineyards. For more than six centuries it has enjoyed a reputation for excellence, which has gradually increased, until at the present time it appears to have reached its utmost celebrity. There is an old historical anecdote which proves that, in the year 1397, champagne was as famous and excellent as it is now. Vincesilaus, king of the Romans and of Bohemia, on his way to the court of Charles VI., to arrange the conditions of a treaty, passed through Rheims, and,

for the first time in his life, tasted champagne. He became so fascinated with the drink, that he refused to proceed on his diplomatic errand, but took up his quarters in the town, and throwing aside business, passed his time in making and keeping himself drunk with champagne. To be enabled to stop as long as possible in the country, he gave up every point in dispute. It is asserted that Henry VIII. of England owned a vineyard at Ay, from which the wine served at the royal table was made.

The grape from which this wine is procured is, strange to say, of a dark black colour, although the wine expressed from it is of so light and transparent a hue. In making this wine, a most tedious and careful process has to be gone through. Every grape that is in any way bruised, or not thoroughly ripened, is rejected. To obtain the grey, or, as it is called, white champagne, the grapes are trodden for a quarter of an hour before being pressed. The rose-coloured or pink wine is obtained by prolonging the treading until only some of the colouring matter in the husks is expelled and tinges the wine. Sometimes, in wines of second quality, this rose colour is artificially given by means of a small quantity of strong red wine, or even of a liquor made from elder-berries. All who are acquainted with the true flavour of wines will never think of touching the pink champagne, when they can obtain the white.

The value of the vine land in Champagne is enormous. Some of the vineyards have been sold at the rate of £800 an acre, whilst the commonest quality realized £40. To the purchase-money of the estate must be added the great expenses of the cultivation employed, which, as in the method followed at Ay, amounts to about £2 the acre. The entire quantity of wine of all colours and kinds, both red, pink, and white, manufactured in the province of Champagne is computed at 40,968,033 gallons, produced from 138,870 acres of vines, but of these, what is commonly

known as champagne—the white effervescing wine—forms only a sixth part.

Champagne wines are generally divided into white and pink, and again into still and sparkling. The best of these still wines is that called Sillery, a clear, dry champagne of a bright amber colour, rich body, and powerful bouquet, which is almost entirely sent to England and Paris. At the vineyard itself, the cost price of this wine, when new, is about three shillings the bottle. The vineyard which produces it is not more than forty-five acres in extent, and is situated on a hill, with an easterly aspect. The soil abounds in chalk mingled with stones, and the vines are planted closely together. The best effervescing champagnes are made from the vineyards on the banks of the Marne. It is on one of the calcareous declivities that border this river that is situated the vine plantation of Ay, whose wines are so light, delicate, and vinous, that they are celebrated all over the world. The soil is similar to that in which the vines of Sillery are planted.

The products of the celebrated vineyards of Mareuil, Dizy, and Hautvilliers all belong to the first class of champagne, being all of the best quality, and only differing in colour and effervescence. The vineyards of the celebrated Moët are situated in Epernay, and its produce, which is almost equal to that of Ay, was, until lately, entirely bought up by the Russian government.

An immense quantity of manufactured champagne is sold in England. The most harmless deceit is that of importing a cheap light French wine, which in the country may be purchased for a few pence the bottle, sweetening and colouring it, and then passing it off as the best champagne. Many persons judge of the quality of this wine by its tendency to effervesce, and the force and report with which the cork flies from the bottle. They should remember that this is due to carbonic acid gas, and not to the quality of the

wine, and can easily be produced in any kind of liquid, whether it is called champagne or soda water. The best kind of this delicious wine is, as we said before, Sillery, which is a still wine, and does not give off any gas; but it is its wonderful and peculiar flavour and bouquet which has earned it the great reputation it enjoys. In these imitations, if the gas is allowed to escape, it will be found that the dead liquid which remains is nothing more than a sweetened fluid, without odour and distinguishing taste. A cheap and, as it is at the same time termed, a first-rate champagne is often sold in England; but in France, from whence it is imported, it is impossible, for a first-rate champagne is never cheap. The best qualities vary in price from three shillings, when new, to four, when old; and but few growers will allow their stock to leave the cellar until it has benefited from age. With land and sea carriage, bottling, and duties, this cost is of course greatly increased. But if the champagne has been manufactured after the following receipt, we can easily understand that, at even one shilling a bottle, a very handsome profit could be realized. "*Champagne.*—Take of white sugar, eight pounds; the whitest brown sugar, seven pounds; crystalline lemon acid, or tartaric acid, quarter of an ounce; pure water, eight gallons; white grape wine, two quarts, or, perry, four quarts; of French brandy, three pints. Boil the sugar in the water, skimming it occasionally, for two hours; then pour it into a tub, and dissolve in it the acid before it is cold. Add yeast, and ferment. Put it into a clean cask, and add the other ingredients. The cask is to be well bunged, and kept in a cool place for two or three months; then bottle, and keep it cool for a month longer, when it will be fit for use. By adding one pound of fresh or preserved strawberries, and two ounces of powdered cochineal, the pink champagne may be made." This compound would be sufficient to make five dozen and a half of champagne, at an entire cost of about twenty-three shil-

lings, so that if retailed at even the low price of thirty shillings the dozen, the profits would be £7 2*s*.

It is a common practice with low dealers to buy up the bottles in which the real wine has been imported, and to refill them with gooseberry wine. At fairs, races, and crowded balls, this trash is easily passed off at an enormous price—frequently ten shillings a bottle. There is but one safeguard against these deceits, and that is by purchasing the wine from a dealer of known respectability, and who, although he will suit the price you offer with any quality of champagne, will still vend that which is wine, devoid perhaps of both flavour and bouquet, but, at any rate, not a manufactured wash or health-destroying substitution.

Claret Wines.—Under this head are included a great variety of different wines, the produce of vineyards situated in the department of Gironde, in France, and which also include those grown in the vicinity of Bordeaux. About 350,000 acres of land are devoted to the culture of the vine; and some of the estates are so valuable, that the one called Mouton, which comprises some 150 acres, was sold some twenty years since for £365 per acre; whilst that of Lafitte, of 262 acres, brought £183. On the Medoc estate, the land, taking one vineyard with another, is valued at £70 per acre, all round.

The celebrated Chateau Margaux is grown in the commune of Margaux, a fine light wine, with a perfume of violet, and a rich ruby colour. It is well known in England; but its delicious flavour has usually been destroyed and spoiled by the addition of brandy. St. Estèphe, St. Julien, Pouillac, and La Rose are all Medoc clarets, and are light, agreeable, and aromatic wines, leaving a powerful and delicious flavour on the palate, and exhilarating gently, without any after depression.

In the district called the Graves, from the gravelly nature of the soil, are the famous vineyards which produce the celebrated Haut Brion, a wine much

valued for its peculiar flavour and its powerful perfume, which resembles a mixture of violets and raspberries. The vineyards which yield the well-known Latour, and the no less esteemed Lafitte, are both situated in one of the communes of Medoc. Of the two wines, the Latour is the better, from its superior body and consistence. These clarets are both extensively bought up for the English market. The soil which produces them is composed of sand and gravel. They have a fine violet perfume and taste, and their colour is also of a dark violet.

A great deal of the claret sold in this country is nothing more than a common, cheap, sharp wine, which in France is considered as a peasant's wine, and ordinarily sold in the drinking-shops, which, owing to the high price which good claret commands, is imported into England, and passed off, at seven or eight shillings a bottle, as superior Latour, Lafitte, or Chateau Margaux. Persons who drink these abominable impurities, complain that they are as sour as vinegar, and occasion pains in the stomach. They therefore conclude that all French wines have similar effects, and are unwholesome; but we can assure them that in France itself the same results invariably follow the drinking of such bad wine.

New claret is made to imitate old, by pouring out a small quantity of the wine, and then standing the recorked bottles into water, which is gradually made to boil. The poured-out wine is then replaced, the bottles dressed up to have an aged look, and finally passed off for ten years' old claret. Occasionally, a cheap common French wine is mixed with rough cider, and coloured up to the appearance of claret with cochineal, logwood, and other materials, and in the end disposed of to the customer at seventy shillings the dozen. It is no wonder that a dislike to claret should be as strong in these days, as the love of it was violent in olden times. In an old work, written in the sixteenth century, we find the follow-

ing:—"Claret is a noble wine, for it is of the same complexion that noblemen's coats be of; and therefore, to furnish their noses with a bud of this tincture, they scarlet fire that promontory, to signify they are such or such noblemen's musicians."

Burgundy.—This wine is justly celebrated for the many excellent qualities it enjoys. It is certainly the most perfect of the red wines, possessing a powerful aroma, a delicious and lasting flavour, and a gently stimulating effect. On the Continent it is highly esteemed; but in England it is less known, being too often confounded with claret.

The ancient dukedom of Burgundy is now divided into three departments, the Côte d'Or (so called in compliment to the great value and beauty of its vineyards), the Saone-et-Loire, and the Yonne. Of these three, the Côte d'Or is the most renowned for its wines. It is an undulating country, whose hills present southern and south-eastern aspects, both of which encourage the growth of the vine. The Yonne stands next for its delicious wines, and the luxuriancy of its plantations. The value of the wines manufactured in these three departments amounts to nearly a million and a half sterling. The principal Burgundy wines are Romanée, Conti, Chambertin, Clos Vougeot, St. George, and Mont Rachet, all of which are the produce of the Côte d'Or; whilst those of the Saone-et-Loire, such as Moulin à Vent and Torins, are wines of a second quality; and those of the Yonne, such as Preaux, Olivetes, and Perrière, may almost be ranked as third-class produce.

Burgundies undergo the same adulteration as clarets, only as they are known to be stronger wines, more brandy is added, and so their peculiarities are completely destroyed. For so delicate and peculiar are their characteristics, that even if two pure and good Burgundies are mixed together, the bouquet and taste are entirely changed. Burgundy is a slight astringent, and in England, the medical profession consider

it to be an unwholesome wine, apt to occasion headaches or indigestion. As very little Burgundy arrives in England, but generally a mixture of Burgundy and brandy, perhaps that may in some measure account for its evil effects.

Wines of Germany. — These wines are much esteemed for their powerful perfume and light agreeable qualities. They are principally produced on the banks of the Rhine, and those of its tributary rivers, the Moselle and the Mayne. The vine which is generally cultivated is that called the Ressling, which bears a small fruit, with a harsh disagreeable taste, but nevertheless producing wines which are remarkable for their fine aroma and pleasing flavour.

The best of all Rhenish wines is undoubtedly that made at Johannisberg, a town with a castle, on the banks of the Rhine, a short distance from Mentz. In the court-yard of the castle is planted the vineyard which produces the renowned Johannisberger. The quantity of wine obtained is small, and the price it commands is enormous. For the last two centuries this property has been owned by nobles and princes. In the year 1807 the Emperor Napoleon took possession of it by right of conquest, and presented it as a great reward to Marshal Kellermann, who enjoyed it for nearly eight years. At the Congress of Vienna it was restored to the Emperor of Austria, who, in his turn, rewarded with it the services of Prince Metternich. In making the best quality of this wine, the greatest care and attention are bestowed, none but the best berries from the ripest bunches being selected. The bottles bearing a blue seal are considered to contain the best specimens of this wine, and are never to be met with but at the tables of princes, to whom they have been given as a rare and costly present.

The Steinberger, produced on an estate belonging to the Duke of Nassau, is said almost to rival the Johannisberger. The vineyard contains about 108 acres, and is entirely surrounded by a wall. In a

year of good vintage, such as that of 1846, a *stück* (cask) of this wine (240 imperial gallons) is readily purchased for £240. In the year 1836, a peculiar specimen of this wine, which, for its excellence and delicacy, had been surnamed "the Bride," was sold by auction, and bought up by the agents of several royal houses, and three London merchants, at the enormous sum of twenty shillings a bottle.

Near to Frankfort and Mayence, on the banks of the river Mayne, stands the town of Hochheim, surrounded by the vineyards which produce the well-known Hochheimer, or, as we term it, Hock. Formerly it was customary with Germans to keep this wine until it was fifty years of age. Another valued kind of German wine is the Rudesheimer, which, for its high quality, is eagerly bought up on the spot at enormous prices, averaging from seven shillings to half a guinea a bottle.

The wines grown on the banks of the Moselle are light, and not so much esteemed as those of the Rhine and Mayne. Of late years they have become fashionable in England. The most celebrated varieties are the Scharzberger, and the Grünhäuser, formerly called the "Nectar of the Moselle," which is said to enjoy the singular property of increasing the health of those who become intoxicated with it.

The adulterations of German wines are generally confined to Hock and Moselle. Cheap light French wines are perfumed with essences, placed in bottles of the colour and shape peculiar to the Rhenish wines, and often passed off, at enormous prices, as the choicest specimens of the German vineyards. In England the demand for them is small, so that as yet it has not been worthy of the attention of the trade to adulterate largely; for, as the customers are few and far between, and these sophistications spoil with keeping, the loss would be larger than the profits gained by the deceit.

"When used in moderate quantities," writes Dr. Pereira, "as to the extent of two or three glasses

daily, wine proves a very grateful and, to those who have been accustomed to it, an almost indispensable stimulant. It quickens the action of the heart and blood-vessels, diffusing an agreeable warmth through the system, promotes the different secretions, augments the muscular force and activity, excites the mental powers, and banishes unpleasant ideas and reflections." The same authority lays down the following conditions for avoiding any ill effects from wine-drinking, viz., the temperate use, the goodness of the liquor, the seasonable time of taking it, and the health of the individual.

CONDIMENTS.

Cayenne Pepper.

When the dried pods of *Capsicum annuum* and the *Capsicum frutescens* are ground into powder they constitute what is called Cayenne pepper.

The *Capsicum annuum* is a native of America. It is, according to M'Culloch, one of the hardiest and most productive plants found in tropical climates, growing luxuriantly in almost all dry soils, however indifferent. The pods of this capsicum are hot and pungent, but they have no aroma.

The pods of the *Capsicum frutescens*, on the contrary, possess to some extent an aromatic quality, and from them the best description of Cayenne is manufactured.

This pepper is, according to Accum, sometimes adulterated with red lead, to prevent its becoming bleached on exposure to light. This fraud may be easily detected by shaking up part of it in a stoppered bottle, containing water impregnated with sulphuretted hydrogen gas, which will cause it speedily to assume a dark, muddy, black colour.

Mr. Braude, in his "Manual of Pharmacy," says, that this pepper is often mixed with half its weight of common salt. Other adulterations are practised upon it, such as the addition of coloured sawdust,

Another and more simple method for discovering the

presenee of red lead, is by the rapidity with which it sinks in water through which the pepper is diffused.

"Cayenne pepper," writes Mr. Mitchell, "is often subject to a very deleterious fraud. When exposed to light for any time, it always loses the fine bright red colour it at first possesses, and therefore becomes deteriorated in the eyes of the purchaser. In order to prevent this, a quantity of red lead is added, which not only causes it to keep its colour for a greater length of time, but also adds to the weight, and consequently to the profit of the vendor."

Dr. Normandy asserts that he has often found red lead in Cayenne pepper; but, generally speaking, the adulteration was ground rice and *brick-dust*, which appears to be a very valuable article for the purposes of adulteration. He also discovered common salt to a very considerable extent. Some samples of this pepper consist entirely of common salt, coloured with a little Cayenne.

Another excellent manner of detecting these adulterating substances is, to mix one part of the suspected pepper with three of nitrate of potash, and place them in a red-hot crucible, in small quantities at a time. The mass left behind, after the burning, must be digested in weak nitric acid, and then, if any red lead or brick-dust has been present in the pepper, it will, of course, be left behind.

The adulteration by salt may be detected by placing the pepper in distilled water, filtering and adding to the liquid a few drops of an aqueous solution of nitrate of silver. If a white curdy precipitate appears, it is a certain proof that salt is present. The delicacy of this test is astonishingly great; one grain of common salt dissolved in 42,250 grains of water (rather more than five pounds) is rendered obvious by "a milkiness" being produced in the fluid.

Dr. Hassall affirms that, out of twenty-eight samples of Cayenne pepper which he purchased at different shops in London, he, on analysing them, found only

four to be genuine, the others being adulterated with *red lead,* Venetian red, red ochre, brick-dust, ground rice, turmeric, and mustard seed. Two of these samples contained nothing but rice, coloured with red lead.

The use of red lead as a means of adulteration is criminal in the highest degree. Taken in small daily doses, as it must be by those who consume much (of the imaginary) Cayenne pepper, it slowly accumulates in the system, and the constitution is certain to be, sooner or later, brought under the influence of the poison.

From Dr. Taylor's book on Poisons we learn that the absorption of lead, when its salts are taken as poisons, goes on with great rapidity, and the metal is soon found in the organs and secretions. When the lead is taken in small and continuous doses, it either destroys the subject, or, even if recovery should take place, the health is completely shattered, and the vitality of the body usually destroyed by paralysis.

That the effects of this poison are tardy was proved by Van Swieten, who gave lead in the amount of *one drachm* daily for ten days, before it caused any material symptom; but that they are sure in their effects is also proved by the following case:—

"A female, aged 27, was admitted into Guy's Hospital in April, 1846. About ten weeks before her admission she was suddenly attacked by vomiting and cold shivering, with severe pains in the knees. This continued for some days, after which there were dull, aching pains in the stomach and back. . . . . The third day after her admission *a distinct blue line was noticed on both gums,** and it was found that she could not extend either wrist to a full extent. The day following the paralysis of the extensors of the wrist had become much more marked, and the hands trembled very much. She became insensible, and died a week after her admission. It could not be ascer-

* A certain symptom of poisoning by lead.

tained from her statements that she had taken any poison."

In another case—that of a girl who had (to use the term) recovered from lead-poisoning—although nearly a year had elapsed, she suffered from severe pain in the epigastrium; which was tender on pressure. Nothing could be retained on the stomach; and there was a choking sensation in the throat, with other constitutional symptoms."

"*Lead-palsy would appear to be*," writes Dr. Taylor, "*a more common consequence of small doses frequently repeated.*"

Cinnamon.

Cinnamon is imported into this country in bales, boxes, and chests, principally from Ceylon; also in small quantities from Madras, and occasionally from Java. It is the bark of the *Cinnamomum Zeylanicum*, a species of laurel, acres of which, called cinnamon gardens, are cultivated in the neighbourhood of Colombo, in Ceylon. The bark-peelers only select trees of the best quality, and lop off such branches as are three years old. The peeling is effected by making two or three opposite longitudinal incisions, and then raising the bark by introducing the peeling knife. The smaller quills are introduced into the larger ones, and in this way a congeries of quills is formed, often measuring forty inches long. The bark is then dried in the sun, and afterwards tied up into bundles with pieces of bamboo twigs.

In order to preserve and improve the quality of the bark, black pepper is sprinkled amongst the bales of cinnamon, in shipping them at Ceylon. Mr. Bennet states that ships are sometimes detained for several weeks, through the want of pepper to fill the interstices between the bales in the holds.

When cinnamon arrives in London, it is unpacked and examined; all the mouldy and broken pieces are

removed from it. It is then again made into bales. These are cylindrical, three feet six inches long, but of variable diameter, perhaps sixteen inches, on the average. These bales are enveloped by a coarse cloth, called *gunny*. The cinnamon in boxes and chests is usually the small, inferior, and mouldy pieces.

A volatile oil is distilled from cinnamon, but generally it is inferior both in flavour and odour to the pure bark from which it is obtained, for the act of distillation usually diminishes, more or less, its agreeable qualities.

It is known that it is a custom in this country for dishonest cinnamon dealers to abstract from the bark the greater part of its essential oil, by means of immersing it in hot water. The worthless bark is then re-dried, and offered in the market as ordinary cinnamon.

No means were known for detecting this fraud, until Dr. Hassall suggested the use of the microscope, and pointed out the change that cinnamon undergoes from boiling. This spice contains in the cavities of its cells small starch-corpuscles, which, as in all vegetables, enlarge considerably in size, and undergo a great change of form, when subjected to the action of boiling water.

If the cinnamon has been tampered with, these corpuscles are larger than natural, have lost their proper form, and appear distorted and irregular. If the cinnamon has been subjected to the prolonged action of the water, the starch-granules will have become so broken up and dissolved that they can no longer be detected.

Curry Powder.

This compound is extensively used in this country by persons who have at one time resided in the Indies, where, when mixed up with rice and different meats, it forms a favourite dish. When genuine it is com-

posed of turmeric, black pepper, coriander seeds, cayenne, fœnugreek, cardamoms, cummin, ginger, allspice, and cloves. Curry powder owes its stimulating effects to the essential oils contained in the above-named aromatic substances. Cayenne pepper does not, as is supposed, enter very largely into its composition.

The high price given for curry powder offers a great temptation to dealers to adulterate it with cheap and inferior substances. With some dealers Cayenne is mingled with it largely, so that its warming properties—by which many persons judge of its excellence—may be increased. As we have already shown (see *Cayenne*), this condiment is itself largely adulterated, so that in this instance curry powder suffers from a double fraud. Salt, potato flour, and ground rice are employed to increase the bulk and weight.

The very worst specimens of the adulterated curry powder have been found to consist of nothing more than these latter ingredients, mingled with powdered capsicum berries.

At the most celebrated warehouses, such as those of Fortnum and Mason, or Robinson, or Mills, this article may be obtained in a pure state.

In the inferior samples, red lead has been detected in considerable quantities, due, no doubt, to the adulterated Cayenne pepper employed in their preparation.

Mustard.

Mustard, as used at our tables, is the meal obtained by grinding the seeds of the *Sinapis nigra* and the *Sinapis alba*, or black and white mustard.

The plants were formerly cultivated, on a very extensive scale, in the neighbourhood of Tewkesbury, and also in Durham; but at present it is principally raised in the neighbourhood of York, and throughout other parts of the West Riding. Although mustard is, to

this day, openly sold as the best Durham, still none is grown in that county.

It was not until the year 1720 that mustard was known in the state in which we use it at our tables. Previous to that date, it was prepared by crushing the seeds in a mortar, and then freeing them from the particles of adhering husks. But, at the period above stated, it occurred to a woman of the name of Clements, residing in Durham, to grind the seed in a mill, and subject the meal to the same process that flour undergoes. Her mustard soon became popular, and George the First approving of it, the fame of it spread all over England. This lady kept her process a secret until she had accumulated a large fortune, when she gave it to the world, and retired from business.

Mustard is of considerable importance in the Materia Medica. It is employed, in most cases of poisoning, as an emetic, in doses of from a teaspoonful to a table-spoonful in from four to six ounces of water. It is also extensively used as an outward application, in the form of a cataplasm, or in imparting stronger stimulating effects to warm baths.

Like most substances that are sold in a manufactured form, mustard undergoes an extensive adulteration. It is impossible to procure it in a genuine condition, whatever price the purchaser is willing to give. Perhaps the most conclusive proof of this statement is, that Dr. Hassall examined and analysed no less than forty-two samples of mustard, purchased within the last twelve months, at different shops in the metropolis, and found them to be all largely adulterated.

The substances used by the trade for falsifying this condiment are wheaten flour, pea flour, and linseed meal, all highly coloured with turmeric, to give them the requisite yellow colour; and sometimes, when the adulteration has been excessive, Cayenne pepper is added, to restore the hot flavour. Of these materials,

however, wheaten flour is that which is mostly employed; indeed, the others are only occasionally to be met with. It is rarely that the so-called mustard sold at shops contains more than twenty per cent. of the original seed.

Mr. R. Warrington, the chemical operator at Apothecaries' Hall, has stated that several specimens of mustard have, from time to time, passed through his hands, which he found to be sophisticated with plaster of Paris. On burning, they yielded from twenty-seven to thirty per cent. of inorganic matter, whereas pure mustard only yields from four and a half to six and a half per cent.

The article sold in pots, under the name of patent mustard, is, according to Accum, composed of two ounces and a half of Cayenne pepper, a pound and a half of bay-salt, eight pounds of mustard flour, and a pound and a half of wheaten flour, made into a stiff paste with the requisite quantity of water, in which the bay-salt is previously dissolved.

When the mustard purchased in the shops is of an unnaturally brilliant yellow colour, it may be safely concluded that turmeric has been used. To ascertain this, the nicest method is to examine some of the mixture under the microscope; but as all persons are not acquainted with the appearance and characteristics of turmeric, perhaps the easiest test for its presence is to add to the mustard a few drops of a solution of potash, or, indeed, any other alkali, for they all enjoy the property of changing the bright yellow of that root to a brown or deep orange tint.

Unless a microscope is employed, it is impossible to form any just opinion of the extent to which mustard has been adulterated with wheaten flour. Iodine cannot be used, because it not only turns the wheaten flour blue, but it has a similar effect upon mustard meal and turmeric,

The seeds of the white mustard (*Sinapis alba*) were formerly taken in large quantities as an aperient;

but this absurd practice, as Dr. Pereira has justly observed, was attended with some danger, owing to the tendency of all insoluble substances of this description to collect in the intestinal canal, and there give rise to inflammation and ulceration.

The physical properties of pure mustard meal are sufficient to identify it. Strong nitric acid added to a decoction or infusion, strikes a deep red colour; and a persalt of iron also produces a similar effect, but with this peculiarity, that the tint may be immediately discharged by a few drops of a solution of corrosive sublimate.

"The practice," writes Dr. Hassall, "of making inferior qualities of mustard, such as 'seconds' and 'fine' mustard, is open to much objection, since it gives the unscrupulous grocer the greatest scope for imposition. The poor man buys his mustard by the ounce, and for this he usually pays a penny, receiving so much 'seconds,' 'fine,' or 'superfine' mustard as the case may be, according to the conscience of the vendor. As we have seen, 'seconds' may be sold retail, and realize a profit, at fivepence a pound; 'fine' at eightpence, and 'superfine' at elevenpence per pound. We are now, then, in a position to judge of the extent to which the poor man is frequently defrauded in the article 'mustard.'"

Pepper.

The pepper of commerce, which is so highly prized as a condiment, is obtained by grinding into powder the berries of the *Piper nigrum*, a climbing plant, which grows wild, and is also extensively cultivated in both the East and West Indies, in Java, and many other islands. In a state of nature this plant attains the height of twenty feet, but, in order to increase its bearing powers, it is usually restrained from growing taller than twelve feet. After the third year it commences

to produce the berry, which it continues to do for about twenty years, when it ceases to be worth keeping. The fruit, which it gives abundantly from all its branches, is somewhat like clusters of currants, and, when ripe, of a bright red colour; these, when gathered, are spread out on the ground, and dried in the sun. They, like currants, lose their red hue, and become black and shrivelled.

Those berries are most estimated which are heavy, and sink when placed in water. The Malabar pepper pods are those which are considered by the trade to be of the finest quality. They are of a brownish-black colour, and free from both dust and stalks.

The common white pepper is imported from Penang and Singapore. When white pepper is scarce, it is usual to bleach the brown Penang pods.

Ground pepper is so much adulterated, that the only method of obtaining it in a pure state is, like coffee, to buy the article in the grain, and reduce it to powder by a hand mill.

The principal substances used by the dealers to defraud the purchaser are linseed, wheat flour, mustard seed, pea flour, and ground rice.

In the *Times* of the 10th May, 1852, there is a paragraph, stating that a grocer at Chelmsford had been prosecuted by the Excise, and fined £50, for having in his possession a cask purporting to contain ground pepper, the whole bulk of which was 100 lbs., and which contained only two lbs. of pepper, the rest being husks of mustard and rice. The powdered husks of mustard are, at some warehouses, openly sold to grocers for the express purposes of sophistication, as are also the sweepings from the pepper stores, known to the trade as P. D., or pepper dust; and a more inferior kind of this adulteration is sold under the name of D. P. D., signifying the dust or dirt of pepper dust.

Dr. Normandy says, that rape-seed cake reduced to powder is extensively employed for mixing with

ground pepper, and also linseed cake, clay, and potato starch.

The only certain method of ascertaining these frauds is by the microscope. We believe Dr. Hassall was the first to employ it for the examination, and the great nicety with which that gentleman has been able to detect the slightest attempt at adulteration in pepper, at once proves the value of that instrument in all examinations into the sophistications of food. In many instances the Excise officers, although they were morally certain that the pepper had been tampered with, have been unable to prosecute, because their tests for the impurities have not been sufficiently accurate to authorize them in taking legal proceedings.

Some years since it was not uncommon to meet with artificial peppercorns. Accum, in his celebrated "Death in the Pot," says, that he has examined large packages of both black and white pepper, and has found them to contain about sixteen per cent. of this artificial compound. This spurious pepper is made of oil cake, common clay, and a portion of Cayenne pepper, formed into a mass, and granulated by being first pressed through a sieve, and then rolled in a cask. The reader will perhaps remember that a somewhat similar fraud was practised with chicory, by compressing in a machine until it resembled the coffee berry. (See *Coffee.*)

The duty on pepper forms a considerable item in the revenue of the country. In the year 1852 it amounted to £88,112 11*s.*; the quantity entered for home consumption being 3,524,502 lbs., and the present duty 6*d.* per lb.

Let us suppose that every pound of pepper brought into this country is increased by the addition of other substances into three (and this supposition is by no means an improbable one, for in all the Excise seizures the adulterations have far exceeded that proportion; indeed, in the case at Chelmsford, the 100 lb. cask only contained two pounds of pepper); it would then

appear that the revenue is defrauded of the sum of £176,225 2*s*., an amount which, we should imagine, would be a suffieient temptation to ensure a strict wateh being kept upon the tricking propensities of the retail trade.

Pickles.

The adulteration of piekles is curious, from its absurdity and uselessness. It does not eause a saving of the materials used, neither does it impart any peeuliar flavour intended to coneeal the quality of inferior merchandise. The only end aimed at is to tiekle the faney of the purehaser, by imparting, through the medium of poisonous colouring matter, a brighter hue to the goods, and so attraeting eustom, at the risk of the health of the eustomer.

Cooks and housewives have, from time immemorial, been in the habit of imparting what is termed "a fine green colour" to cooked vegetables and piekles by means of eopper. It is by some considered to be an exeellent thing to plaee a penny-piece in the saueepan where eabbages are boiling. In the "Modern Cookery Book," one of the direetions for piekling is to "take a pieee of verdigris the bigness of a hazel nut, finely powdered, half a pint of distilled vinegar and a bit of alum powder, with a little bay salt. Put all in a bottle, shake it, and let it stand till elear. Put a small teaspoonful into codlings, or whatever you wish to green." The "Ladies' Library" gives the following reeeipt for piekling gherkins:—"Boil the vinegar in a bell metal or eopper pot; pour it boiling hot on your cucumbers."

A gentleman of the name of Raffeld, who has devoted mueh attention to the study of making piekles poisonous, reeommends, in "The English Housekeeper," that you should render pickles green

by boiling them with "half-pence, or allowing them to stand for twenty-four hours in copper or brass pans."

On turning to Accum's invaluable work on the adulterations of food, we read—

"Vegetable substances preserved in the state called pickles, by means of the antiseptic power of vinegar, whose sale frequently depends upon a fine lively green colour, and the consumption of which, by seafaring people in particular, is prodigious, are sometimes intentionally coloured by means of copper. Gherkins, French beans, samphires, the green pods of capsicum, and many other pickled vegetable substances, oftener than is perhaps expected, are met with impregnated with this metal. Numerous fatal consequences are known to have ensued from the use of these stimulants to the palate, to which the fresh and pleasing hue has been imparted, according to the deadly *formulæ* laid down in some modern cookery books, such as boiling the pickles with half-pence, or suffering them to stand for a considerable period in brazen vessels."

The best authority that could be consulted on this subject is Professor Taylor. He distinctly asserts that "even the using of copper vessels for culinary purposes is dangerous;" and a not unfrequent cause of accidental poisoning, and he also gives several instances where, by allowing food to stand for twenty-four hours in copper or brass pans (as recommended by "The English Housekeeper") those who partook of such food died. A whole family, according to Dupuytren, was poisoned by eating crayfish cooked and allowed to cool in a copper vessel, to which vinegar had been added; *three persons died.* Another instance is related by Professor Barzellotti, of some monks, who soon after dinner were attacked with violent symptoms of irritant poisoning. It appeared, on inquiry, that the monks were in the habit of keeping their fish, sprinkled with

vinegar, in a copper vessel, which, on examination, was found to be badly tinned. When the fish was examined it was found covered with a green jelly, and the sides of the vessel with which the fish was in contact had a green colour, which was nothing more than what is recommended in the "Modern Cookery Book" as "greening."

It used to be impossible to purchase pickles in London without finding copper, in more or less quantities, polluting the liquid portion. Since attention has been directed by the *Lancet* and Dr. Hassall to this important subject, several of the wholesale houses now manufacture only pure and copperless articles.

One of the largest wholesale pickle manufacturers, Mr. Blackwell, of the firm of Crosse and Blackwell, stated, before the Select Committee on the Adulteration of Food, that for the last thirty-five years it had been the practice, in manufacturing pickles, to use copper vessels when boiling vinegar. The vegetables were scalded first, and then they remained in the vinegar for two or three days, so that the vinegar had time to take up a portion of the copper. The same thing was again repeated two or three days afterwards, and was repeated till the vegetables became of a green colour.

When we call to mind the case above mentioned, where three persons died of eating cray-fish, cooked and allowed to cool in a copper vessel, to which vinegar had been added, it is truly marvellous that the public should have escaped from being poisoned by pickles that had been kept in a copper pan for a time never less than three days, and generally double that period.

Since the articles appeared in the *Lancet*, Messrs. Crosse and Blackwell have abandoned this process. At first their business was affected by the change. Their customers—retail dealers—wrote to them, complaining that their goods were not so green as formerly. A label was then pasted on each bottle, stating the cause of the less attractive colour of the articles; since then

the complaints have ceased, and the change has been found advantageous to the firm, by increasing their trade.

For the tests to be employed for detecting the presence of copper in the vinegar of pickles, see *Bottled Fruits*.

VINEGAR.

Perfectly pure vinegar should consist of acetic acid diluted with water, and flavoured by a peculiar ether obtained by the substances which have undergone acetous fermentation.

When any fermented or saccharine liquid, or even alcohol and water, is mixed with yeast and exposed in a warm place to the open air, it becomes agitated, heat is developed, the fluid becomes turbid, and carbonic acid is disengaged. Oxygen is absorbed from the atmosphere. These changes, after a time, cease spontaneously; the liquor again becomes clear, and, instead of alcohol, it is now found to contain acetic acid. This process is what chemists call the acetous fermentation. The degree of heat most favourable to the operation varies between 70° and 80°; and the presence of water is also essential.

In this country a great quantity of vinegar is made from a solution of brown sugar or molasses. It is, however, more generally produced by subjecting an infusion of malt, or of a mixture of malt and raw barley, to the acetous fermentation. This is the reason why they are called in the trade malt vinegars.

Pyroligneous acid, or, as it is called by some persons, wood vinegar, is obtained by the distillation of wood, and is largely employed in the pickle trade. Some idea of the strength of wood vinegar may be formed, when we state that it contains about thirty per cent. of anhydrous acid, whilst that made from wine and malt liquor never exceeds five per cent.

When first manufactured, pyroligneous acid is very impure, and of a dark colour, holding in solution tar and volatile oil. When purified, it consists of acetic acid and water.

There are several kinds of malt vinegar manufactured, each varying in strength, the most powerful of which is known as *proof vinegar*. It is too strong for ordinary domestic purposes, but is largely employed for pickling and preserving, on which account it is also called *pickling vinegar*. That sold under the name of *best pickling vinegar* is the variety best adapted for the table. Malt vinegar has, according to the best analysis, been found to be of the following composition :—

Acetic acid.
Acetic ether.
Colouring matter.
Peculiar mucilaginous matter.
A small quantity of alcohol.
Sulphuric acid, of which the law allows the addition of $\frac{1}{1000}$ part.
Water.

The addition of sulphuric acid has been permitted by the legislature, because it is said to be necessary for the preservation of the vinegar, which without it would, in the course of a short time, become decomposed. Vinegar is very liable to suffer decomposition. It becomes turbid, loses its acidity, and acquires an unpleasant musty odour. The thick coat or skin, somewhat resembling leather, which gathers on the surface of the liquor, is known as the mother of vinegar, and consists of an infinity of exceedingly minute vegetables of a spheroidal form. Sometimes the surface of vinegar is covered with a mouldiness, which, when examined by the microscope, is found to consist of minute fungi, called by botanists *mucor mucedo*. Small animals, to which the name of vinegar eels has been given, may, by the aid of the microscope, also be discovered in decomposed vinegar. The best way

to destroy them is by heating the vinegar. A small fly, called the *musca cellaris*, is also peculiar to vinegar.

In France vinegar is prepared by exposing weak wine to the air during the warm weather. Wine vinegar may be distinguished from malt vinegar by ammonia, which occasions in the former a purplish precipitate, but not in the latter. The most celebrated French vinegars are those made at Orleans, which are mostly manufactured from white wines.

The most common adulteration of vinegar is to mix the inferior malt vinegars with pyroligneous acid. This imitation has not so fragrant an odour as the genuine article.

The dark colour of the vinegar sold in England is owing to the presence of burnt sugar, which is added solely for colouring purposes. Why this absurdity should be persisted in it is impossible to say, since the most valuable wine vinegars are principally distinguished for their light, bright, and transparent clearness.

The permission which has been accorded by the law to manufacturers to add a small quantity of sulphuric acid to their vinegar, has, unfortunately, been largely taken advantage of for the purpose of giving a false strength to otherwise worthless produce. The weak vinegars, which they sell at a low price, are, without greatly increasing their cost, made to equal in acidity the better class of manufactures, by employing sulphuric acid.

It has been stated by some, who have written on the adulterations of vinegar, that bad cider and grains of paradise are largely employed as sophistications; but whatever the practice may have formerly been, the only falsification that takes place in the present day is by employing sulphuric acid.

There are several methods for detecting the presence of this acid in vinegar. If a drop be placed on paper and dried at the fire, it leaves a black stain. Or if some of the adulterated vinegar is added to a hot

solution of cane-sugar it becomes black, owing to the sugar becoming carbonized.

Mr. Mitchell asserts that if a drop or two of pure vinegar be placed upon blue litmus paper, the latter will be reddened; but when dried before a fire, the red colour disappears, and the original blue again presents itself. But this test is not to be relied upon, for although with pure acetic acid, which is very volatile, it might give such a result, still as all vinegar of commerce contains a small quantity of sulphuric acid, the red stain, instead of disappearing, is rendered more permanent by heat.

The only certain test for the presence of sulphuric acid is by adding to the vinegar a solution of baryta, when the insoluble sulphate of baryta will be instantly formed, and precipitated as a white powder. According to the amount of this white precipitate, the operator will be enabled to judge whether more than one-thousandth part of sulphuric acid (the amount permitted by law) has been added to the vinegar.

Vinegar is, when taken in small quantities, a wholesome, cooling, and thirst-allaying condiment. The habitual use of it in large quantities is injurious, disturbing the digestive organs and wasting the body.

Many persons drink it for the purpose of obtaining slim figures; but that such a practice is dangerous is shown by Giacomini, who gives the following case. "A few years ago a young lady, in easy circumstances, enjoyed good health; she was very plump, had a good appetite, and a complexion blooming with roses and lilies. She began to look upon her plumpness with suspicion, for her mother was very fat, and she was afraid of becoming like her. Accordingly she consulted a woman who advised her to drink a small glass of vinegar daily. The young lady followed her advice, and her plumpness diminished. She was delighted with the success of the remedy and continued it for more than a month. She began to have a cough; but it was dry at the commencement,

and was considered as a slight cold, which would go off. Meantime from dry it became moist; a slow fever came on, and a difficulty of breathing; her body became lean, and wasted away; night sweats, swelling of the feet and legs succeeded, and a diarrhœa terminated her life. On examination, all the lobes of the lungs were found filled with tubercles, and somewhat resembling a bunch of grapes."

NARCOTICS.

Tobacco.

Cigars—Cheroots—Tobacco—Snuff.

The tobacco of commerce consists of the dried leaves of the *Nicotiana tabacum*, prepared in different ways, either by being cut into fine threads, such as is smoked in pipes; or by the entire leaves being rolled together, as in the cigar; or by being ground into a powder, as in snuff. It may be classed among the luxurious necessities of man, who, despite the ban placed upon it, as if to deter him from its indulgence, by causing sickness and vertigo, has learned to overcome and habituate himself to its evil effects, and add another want to the already long list. Its consumption is said to be next to salt in quantity, and to equal that of tea.

According to Humboldt, the tobacco-plant has been for ages cultivated and used in America. Its introduction into Europe was consequent upon the discovery of that continent, but there is good reason to believe that tobacco was indulged in by Asiatics long before that period.

Meyen, the celebrated botanist, says that it has long been the opinion that the use of tobacco, as well as its culture, was peculiar to the people of America; but this is now proved to be incorrect, by our present

more exact acquaintance with China and India. The consumption of tobacco in the Chinese empire is of immense extent, and the practice of smoking seems to be of great antiquity, for on many old sculptures he has observed the very same tobacco-pipes which are still used. Besides, we know the plant which furnishes the Chinese tobacco; it is even said to grow wild in the East Indies. It is certain that this tobacco plant of eastern Asia is quite different from the American species.

Columbus and his followers were the first Europeans who witnessed the smoking of tobacco, when, in the year 1492, they landed in Cuba, and were met by the native chiefs smoking cigars. Some years afterwards, Cortes found the Mexicans indulging in a similar pastime. Both the plant and the custom of smoking it was subsequently introduced into Spain by Hernandez de Toledo; and, in the year 1559, Jean Nicot immortalized himself by sending from Portugal to France seeds of the plant, for it was named after him. It was not until the year 1586, or twenty-six years after it was known to the French, that Sir Francis Drake, on his return from Virginia, introduced the leaf into England; and Sir Walter Raleigh kindly undertook to teach his fellow-countrymen the manner of smoking it.

The cultivation of tobacco is forbidden in England, because the import duty furnishes a considerable item to the revenue; not more than two yards and three quarters of it (half a pole) being permitted to be cultivated, and then only for botanical purposes.

The tobacco plant is now to be found in every quarter of the globe. It is extremely hardy, and can endure unhurt the changes of temperature, altitude, and general climate. It is grown in North and South America, in the West India Islands, in Asia, Africa, and in Europe, where it is raised with success in almost every country; and it is cultivated with great commercial success in Hungary, Germany, Flanders, and France.

Although great efforts, on its first introduction into Europe, were made to abolish the smoking of tobacco, the practice, despite of laws, writings, and religious entreaties, gradually gained ground, until, at the present time, it is universal. The well-known "Counterblast to Tobacco," written by King James the First, instead of checking rather drew attention to the habit, and little good resulted from the royal assertion that it was "a custom loathsome to the eye, hateful to the nose, harmful to the brain, dangerous to the lungs, and in the black stinking fume thereof neerest resembling the horrible Stygian smoake of the pit that is bottomless;" for his Majesty's subjects continued to fill and smoke their pipes, more secretly perhaps, but also more assiduously than before. Pope Urban VIII. thought the matter so serious, that he issued a bull against the "loathsome custom;" and in Russia the knout was threatened to those convicted of the first offence of smoking, and death for the second. In the East, princes and priests denounced smoking as a "filthy sin, and a departing from the injunctions of the Prophet." Yet it is in the East that the most confirmed smokers are to be met with. Mr. Crawford states that the Burmese, of all degrees, sexes, and ages, smoke cigars, even down to infants of three years old. It is well known that in China the women, as soon as they have attained their eighth year, carry suspended to their sides a pouch to contain their tobacco and pipe. In America it is no uncommon circumstance, when a coroner's inquest has been held on the body of a youth proved to be a confirmed smoker, for the jury to return a verdict of "Died from excessive tobacco-smoking."

The consumption of tobacco in England is enormous. From the Government returns we find that the quantity imported for home consumption was, in the year 1853, 29,737,561 pounds, of which twenty-five millions, or nineteen ounces per head, were used

in England; and the remainder, or twelve ounces per head, in Ireland. It is computed that, in France, the average yearly consumption of tobacco is $18\frac{1}{2}$ ounces per head; in Holland, it is seventy ounces, or $4\frac{1}{2}$ pounds per head; and in Belgium it amounts to $73\frac{1}{3}$ ounces, or $4\frac{3}{5}$ pounds per head. In America and also in the Eastern nations, the average consumption is still larger; indeed, Mr. Crawford has estimated that, taking the entire population of the earth at a thousand millions, each individual smokes, in the course of the year, seventy ounces; and that the total amount of tobacco produced and consumed amounts to 4480,000,000 of pounds.

The very finest leaf known is the produce of the island of Cuba, better known in this country as Havannah tobacco. The celebrated Manilla cigars are manufactured from the produce of the island of Luzon, in the Philippines. That delicious and highly esteemed tobacco called Latakia, is grown in Syria, and is obtained from a plant similar to that which is now, and has for centuries been, cultivated in China. The Dutch have paid much attention to the cultivation of this produce, and raise about 2,000,000 pounds yearly, of which the greater portion is exported to America and Cuba, where, on account of the delicate texture of the leaf, it is used for the outer covering of cigars.

The two principal chemical ingredients of tobacco are nicotine and nicotianin, and from these it derives its active properties.

Nicotine exists not only in the leaves, but in the roots, seeds, and even the smoke of tobacco. When obtained, it is a liquid of a yellowish colour, which becomes darker by exposure to air. It has a pungent irritating odour, like that of tobacco, and also an acrid burning taste.

Schloesing has, by analysis, estimated the different amounts of nicotine to be found in different kinds of tobacco.

Nicotine in 100 *parts of leaf.*

Virginia	6·87	Maryland	2·29
Kentucky	6·09	Havannah (best cigars) less than	2·00

The French tobacco contains from four to seven per cent. of nicotine.

It is not many years since an immense sensation was created in Europe by a murder committed by means of nicotine. The Count Bocarme, a Belgian nobleman, to possess himself of certain estates, poisoned his brother-in-law with an infusion of tobacco. Whenever the use or application of this plant has proved fatal, it is always owing to the action of this poison. When applied as a poultice to wounded or diseased surfaces it may occasion the most alarming symptoms. A youth afflicted with ringworm was killed by having tobacco leaves applied to the sore.

As a poison, nicotine is almost as powerful as prussic acid. A single drop given to a dog was sufficient to destroy life; and Orfila, on examining the stomach of the animal on which the experiment had been made, found that the mucous membrane of the stomach was greatly inflamed, and of a vivid red throughout. Dr. Pereira considers that it is not safe to administer medicinally more than twenty grains of tobacco, and as the strongest leaves do not contain more than 8 per cent. of nicotine, the amount of poison present is very small. Dr. Copeland lost his life from employing a dose of thirty grains of tobacco.

Nicotianin is the concrete volatile oil of tobacco, obtained by distilling the leaves. It is also very poisonous. Hermbstädt swallowed a *grain* of it, which produced nausea, giddiness, and inclination to vomit.

The smoke drawn into the mouth during the act of consuming tobacco, either in a pipe or as a cigar, has been analysed by Melsens.* In one hundred

* Ann. de Chim. et de Physique, t. ix., p. 465.

grains of Virginian tobacco he detected the alarming quantity of three-quarters of a grain of nicotine.

When smoked for the first time the effects of tobacco are painful and repulsive. It produces giddiness and sickness; but if often persevered in, the stomach and brain soon become accustomed to the fumes. Many persons object to the use of tobacco, on the ground that it leads to drinking. Dr. Pereira states that "the practice, when moderately indulged, provokes thirst and increases the secretion of saliva." But he adds that it also produces "that remarkably soothing and tranquillising effect on the mind which has caused it to be so much admired and adopted by all classes of society and by all nations, civilized and barbarous." Dr. Christison states that "no well-ascertained ill effects have been shown to result from the habitual practice of smoking." On the other hand, Dr. Prout asserts that "with tobacco, as with deleterious articles of diet, the strong and healthy suffer comparatively little, while the weak and predisposed to disease fall victims to its poisonous operations." He also states that "great smokers, especially those who employ short pipes and cigars, are said to be liable to cancerous affections of the lips."

The question whether the habit of smoking is or is not injurious to health is a disputed point with medical men; but there can be little doubt that, when taken in large quantities, it acts prejudicially upon the system. Drs. Laycock, Wright, and many others, assert that it disorders the digestive functions. Others deny this, on account of the difficulty of proving that the health of inveterate smokers has been impaired, or their lives shortened by the habit. But, as Professor Taylor remarks, "a poisonous substance like tobacco, whether in powder, juice, or vapour, cannot be brought in contact with an absorbent like the mucous membrane without, in many cases, producing disorder of the system." The argument that cases cannot be

adduced to show direct injury to the health proves too much, for the same difficulty exists in respect to the habit of opium-eating. All smokers are willing to attribute their ill health to any other cause than that of smoking, yet if tobacco is relinquished, they are invariably restored to convalescence. To confess that tobacco is the reason of his ailments, would render it necessary for him to deprive himself of what he considers not merely a luxury, but an article actually necessary to his existence.

It has never by any statistical account been clearly established that smoking was a cause of drunkenness. Many smokers drink to excess; but the question is, whether, if they relinquished the pipe, they would not take the same amount of liquor? Among Eastern nations tobacco is, according to Mr. Lane, a cause of temperance. Speaking of the "fragrant weed," he says that, "being in a slight degree exhilarating, and at the same time soothing, and unattended by the injurious effects which proceed from wine, it is a sufficient luxury to many who, without it, would have recourse to intoxicating beverages, merely to pass away hours of idleness." Dr. Madden declares that the Turks when smoking are so wrapt up in the enjoyment that they have no time to think of either thirst or drink. "The pleasure of the reverie consequent on the indulgence of a pipe consists in a temporary annihilation of thought. People really cease to think when they have been long smoking. I have asked Turks repeatedly what they have been thinking of during their long smoking reveries, and they replied, 'of nothing.'"

When tobacco-leaves are pressed together and cut into thin shreds, they form what is called *cut tobacco*—such as shag, birds-eye, returns, etc.

When the leaves are pressed or twisted together into thicknesses, varying from stout string to thick rope, they are designated roll or twist tobacco—such as pigtail, negro-head, and Cavendish.

When they are dried, and then crushed or pounded into a powder, they are spoken of as snuffs.

When the leaves are rolled or folded one over the other, they form what are known as cigars and cheroots.

The adulterations of smoking tobacco generally consist of the introduction of vegetable substances, such as the leaves of the dock, rhubarb, cabbage, coltsfoot, etc. For snuffs, the materials usually employed are malt cummings (the roots of germinating malt), peat, roasted chicory root, sea-weed, terra japonica, and oakum.

To increase the weight saccharine substances are employed, such as treacle, liquorice, molasses, and beet-root dregs.

To make the tobacco burn more easily, and to give it a white ash, such as smokers delight to see, nitre is very often employed.

For different purposes, but principally to increase the colour, appearance, and flavour of tobacco and snuffs, salts and earths are made use of, such as common salt, sal ammonia, potash, yellow ochre, umber, fuller's earth, Venetian red, sand, and chromate of lead.

Strange and contrary to the popular belief as it may appear, Dr. Hassall—the only gentleman who has scientifically examined into the question by employing the microscope, among other tests, for impurities—found that not one of the forty samples of cut tobacco was adulterated with any foreign leaf. The most frequent adulterations consisted of the addition, in large quantities, of water, salt, and some saccharine matter, either sugar or treacle.

The worst kind of fraud committed by the vendors of cigars consists in manufacturing them in this country from common, cheap, and coarse tobacco, and selling them to the public as foreign produce. Nearly all the Cubas sold in England at three-halfpence each, or ten for a shilling, are made in home

manufactories. The Bengal cheroots, at twopence each, or seven for a shilling, many of the threepenny Havannahs, and all the twopenny ones likewise, have never travelled out of the United Kingdom.

All the cigars sold in shops are, according to Dr. Hassall, who examined fifty-seven samples purchased in different parts of London, manufactured from the genuine tobacco-leaf.

A cheroot, "purchased of a hawker in Whitechapel Road," was made of "two twisted wrappers or layers of thin paper, tinted, of a bistre colour, while the interior consisted entirely of *hay*, not a particle of tobacco entering into the composition."

Other cheroots, "purchased at a review in Hyde Park," the Doctor found to consist "externally of tobacco, but made up internally of hay."

The vendors of these luxuries belong to the class of men who attend race-courses, and skating in the Parks. They carry with them a box of these cheroots and a piece of burning tow. As they walk along they shout out, "a cigar and a light for a penny."

The most adulterated and dangerous form in which tobacco is retailed in the metropolis is as snuff.

Dried snuffs are manufactured out of the stalks or strippings "of the leaf," which are rejected in the process of making the cut tobacco, cigars and cheroots. Moist snuffs contain a portion of the leaf as well as stalk.

The habit of taking snuff seems to be more restricted than that of smoking. In Germany, France, and other European countries, it is indulged in by both men and women; but in the East it is entirely unknown. The different methods of taking it are also curious. The more general way is by taking up a pinch between the fingers, holding it to the nose and sniffing. In Iceland, Madame Pfeiffer tells us, "most of the peasants, and even many of the priests, have no proper snuff-box, but only a box made of bone, and shaped like a powder-flask. When they take snuff

they throw back the head, insert the point of the flask in the nostril and shake a dose of snuff into it. They then, with the greatest amiability, offer it to their neighbour, he to his, and so it goes round till it reaches the owner again." The Highlander takes his snuff in a somewhat similar manner. He uses a little shovel to dig the powder out of his "mull," and then raises the charge to his nose and sniffs it up, and thus avoids the unpleasantness of getting his nails filled up, and his shirt-front sprinkled with the grain.

We again make use of Dr. Hassall's patient, scientific, and correct analysis of the different kinds of snuffs, to obtain the ingredients used in the present day for the purposes of adulteration. He examined forty-three samples, which involved all the most celebrated and popular compositions, from Prince's mixture down to Grimstone's eye-snuff.

He found that salt was largely employed, and sometimes to the extent of twelve per cent. The carbonates of lime and potash (usually eight or nine per cent.) formed some of the adulterations. We regret to add, that he detected the poison of *oxide of iron*, red and yellow ochre, *umber*, *chromate of lead*, *red lead*, bichromate of potash, *silica*, and what appeared to him to be *powdered glass*.

To adulterate snuff with lead and bichromate of potash means, in simple words, to adulterate with poison. How is it that such iniquities are allowed? The Excise with all its powers, having a corps of analysts at its command, has failed to detect and punish a criminal cheat, and leaves the office of discovering a contraband wickedness to the industry and scientific research of a physician. Not only are these frauds detrimental to the revenue, but they are dangerous to the public health. Professor Erichson gives the details of a case of slow poisoning by snuff containing lead, which is painfully interesting as a certain proof of the evil results of the tricks of trade.

He was called in to see a gentleman who was said

to be suffering from an attack of paralysis. "Mr. A. B. could stand, and if supported could walk, though feebly and with much difficulty. He complained much of pains about the shoulders and the fleshy parts of the thighs and legs, and especially of burning sensations in the soles of his feet."

What particularly struck the Professor was "the appearance of the hands and arms, which were lying powerless on the coverlet of the bed. There was marked 'wrist-drop' of both arms, the hands hanging flaccid and at right angles with the fore-arms, without the patient being able to extend or raise them in the slightest degree."

Another peculiarity was "the marked degree of wasting of the whole mass of the extensor muscle of the fore-arm. . . . The hands were quite powerless, and the patient was unable to render himself the slightest assistance. The tongue was pale and flabby, and on examining the gums, I found a deep blue-black or leaden-coloured line around the teeth, more marked about the molars. Digestion was much impaired. Appetite capricious, with much flatulence and occasional attacks of constipation, with colicky pains."

Mr. A. B. had been first attacked one year before the Professor saw him. The paralytic symptoms had gradually increased, until he was reduced to a state of complete physical helplessness. Judging from his appearance, the Professor at once concluded that the patient had been slowly poisoned by lead.

He could not, however, ascertain how the poisoning could have been effected. He examined into the sick man's habits, the water he drank, the utensils he used; but all in vain. At length he found out that Mr. A. B. took snuff in considerable quantities. "I accordingly emptied his box of its contents, and took them up to town with me, with the view to further examination. This snuff was analysed by Professor Williamson, who immediately detected in it a considerable quantity of lead; and another supply having

been procured from the same shop at which Mr. A. B. was in the habit of purchasing it, was subjected to analysis by Dr. Garrod, who readily detected large quantities of the metal in it."

Another gentleman, Mr. Fosbroke, a surgeon, was also very nearly falling a victim to this shameful and poisonous adulteration. Paralysis had commenced, but the lead in the snuff was fortunately detected in time. This gentleman describes the treatment that led to his cure. "Iodide of potassium produced no very marked benefit, until galvanism was conjointly tried with it, under which plan I was in a few months fully restored to health."

Another gentleman took the same snuff, and complained of inability to raise the left arm for some time previous to his death.

Another case was referred about a year since to Dr. Letheby; it was that of a gentleman who represented all the symptoms of lead poisoning. An analysis of the snuff (brown rappee) which he took led to the discovery of the source of the poison.

During the last ten years the Commissioners of Excise, who are supposed to protect the public from such iniquities as these adulterations of snuff by lead, have made 368 seizures, and instituted 203 prosecutions for offences connected with tobacco.

"We would undertake," writes Dr. Hassall, "to make as many seizures, or rather detections of tobacco adulterated in one or other of its forms, in the space of three months as are recorded in the above return, which extends over a period of ten years."

Unfortunately for the nation, such public benefactors as Dr. Hassall are not the sort of persons Her Majesty's Commissioners of the Excise either like to imitate, employ, or take advice from.

DRUGS.

Drugs.

In health we have to contend against the adulterations in our daily food, and when, at least, they have rendered us ill, then we have to fight against the adulterations of the medicines that are given for our recovery.

The adulterations of drugs may be divided into three classes: the adulterations which are practised upon the drugs before they reach this country; the adulterations practised by the drug-grinder, or person whose business it is to prepare them for the market, by reducing them to a powder; and the adulterations committed in the shop of the retailing chemist. All the gentlemen examined by the Select Committee on Adulterations of Food, etc., agreed in saying that by far the greater proportion of that adulteration was due to the drug-grinder. The way in which it is done is this: a person having a drug which he wishes ground, forwards a given weight of it to the drug-grinder. The drug is returned to him of the same weight, or nearly so, and sometimes it is even ordered to be returned, weighing so much more. Now, in the process of grinding, part of the moisture, which all vegetable substances contain, escapes. This loss, as well as any that may arise from waste by machinery, is made up by adulteration. It also not unfrequently happens that the dishonest grinder will, for the purpose of increasing his profits, abstract some portion from the article

intrusted to him, and substitute in its place a fraudulent compound, closely resembling in appearance the drug he has been operating upon.

Mr. Robert Warrington, the chemical operator and resident director of the Apothecaries' Company, informs us that the peculations committed by these drug-grinders were so vast, that the Society of Apothecaries were forced to grind their own drugs, to protect themselves against the frauds of the grinders. Even when a man was sent to the drug mill to superintend the grinding of their own drugs, he was enticed down to dinner, or to lunch, or something of the kind; and during his absence all kinds of tricks were played with their drugs.

Dr. Hassall also refers to the following case of fraud practised by a grinder. A member of a very respectable firm sent him a sample of flake cocoa for examination. He examined it, and found it to contain a large quantity of wheat flour. The merchant was very much surprised, and said, "I buy the best cocoa-beans in the market; I forward them to the grinder, and if there is any adulteration, he must be the person who has practised it, not I."

A practice pursued by many drug-grinders is that of adding different kinds of sawdust to drugs, under pretence of cleaning out the mill, but really in order to make up for loss of weight resulting from drying and powdering, and for adulteration. Mr. Redwood, Professor of Chemistry to the Pharmaceutical Society, in an article "on drug-grinding," published in the *Pharmaceutical Journal*, writes, "Sawdust is as indispensable (for the purposes of adulteration) at the drug-mill, as water is necessary in a druggist's shop; and if the druggist sends damp jalap, containing fifteen per cent. of water, to be ground, and requires dry powder to be returned to him, with only four per cent. of reduction for loss, he adopts a conventional method of asking for some of the rinsings of the mill—veritable "powder of post."

Again, Dr. R. Thomson, in his evidence before the Select Committee to inquire into the "Administration of Relief to the Poor," stated, in answer to a question of Mr. Wakley, "that it is common to send to the drug-grinders eighty-four pounds of jalap to be made into a hundred-weight." This same gentleman, before the Committee on the Adulteration of Food, etc., asserted that he knew of one druggist who would sell any powder you pleased at 36*s.* the hundred-weight. No matter what the original price of the pure article might be, he could dilute it down to any value by introducing extraneous matters. When asked if the article was of the best quality, he would reply that it was the best he could afford to sell at the price. Sometimes the article purchased does not contain any of the substance by the name of which it is called.

Calomel.—When a jet of chlorine gas is brought into contact with mercury at common temperatures, calomel, or protochloride of mercury, is always generated.

This drug, being a high-priced one, is very often adulterated with some cheaper ingredient. It is not an uncommon practice to mix it with a large quantity of chalk, often at the rate of sixty per cent. The difference can scarcely be detected by the eye, but it is not difficult to discover the adulteration, if the following tests are applied.

Sulphuric acid has little effect upon calomel. If, therefore, a small diluted quantity of this acid be applied to the suspected drug, and a boiling or bubbling up takes place, accompanied by an ebullition of carbonic acid gas, it may be safely concluded that chalk has been present, in more or less quantities. Another method is to heat the drug to a degree a little below redness, when the calomel gradually rises in vapour, leaving behind all impurities.

Cod-liver Oil.—This medicine is produced in its pure state, by expelling, by means of pressure, the oil contained in the liver of the codfish. The extreme difficulty experienced in testing the purity of this

drug has opened a wide door for fraudulent dealers. It is adulterated with all kinds of oily materials; and in many cases is not cod-liver oil at all. It is known that, even in Newfoundland, the livers of all kinds of fish are taken, and the oil imported to this country as the pure cod-liver oil. We have been informed that there exists at the present time in England a manufactory for the production of the so-called cod-liver oil, which is nothing more than the oleaginous material extracted by pressure from any kind of refuse fish which has been rendered unsaleable, either from decomposition or over-abundance.

When this oil is of a brown colour, Mr. Warrington asserts that it is owing to the livers having been allowed to putrefy to some extent.

Ipecacuanha.—This drug is the powdered root of the *Cephaelis Ipecacuanha*, a plant which grows wild in the Brazils. Its discovery is due to the native Brazilians. It was first used as a medicine in Europe, by Maregraaf and Pison, although it was not until the year 1800 that Dr. A. Gomes brought flowering specimens to Europe, which Brotero described in the "Transactions of the Linnæan Society."

It is difficult to obtain this valuable medicine in an unadulterated condition. It is frequently mixed with tartar emetic. It also frequently contains chalk in large quantities, or wheat flour and starch.

Ipecacuanha is well known to possess strongly emetic properties. It has to be most carefully administered; for, like quinine, when taken in even small doses, its effects are highly poisonous. It is therefore one of those drugs in which the medical practitioner dare not make any allowance for adulteration.

Ipecacuanha in powder has a fawn-brown colour; by strong nitric acid it is turned to a rich green colour, passing speedily to brown. Sulphuric acid carbonizes it in contact. Iodine water gives to it a deep blue colour. Potash has no immediate effect, but the liquid becomes slowly brown. When heated

in platina, it burns without melting, and leaves a white ash.

Small quantities of the suspected drug ought to be submitted to these tests, and if the results are not similar to those above given, it may be safely concluded that the medicine has been adulterated.

Jalap.—This well-known and potent medicine is the root of the *Convolvulus Jalapa*, a climbing plant commonly met with in Mexico, where it grows wild in the woods and on the slopes of mountains. At Xalapa, where the largest quantities are obtained, and imported to this country, the price of this drug is about sixteen pence the pound.

This root, when powdered, is given as a safe purgative to adults, in doses of from ten grains to half a drachm. Its properties are ascribed to a resinous principle, of which the powder contains about ten per cent.

As jalap, in order to be reduced to powder, has to pass through the hands of the drug-grinder, it very rarely happens that it is returned to the druggist without being adulterated with sawdust, or "powder of post," as it is called. The druggist, when he sends jalap to be ground, will very often request that the weight of the dry powder to be returned should be equal to the weight of the drug sent to be powdered. But there is always a loss of from ten to fifteen per cent., caused from the evaporation of moisture during the grinding operation; if this loss has to be made good, it must be done by the addition of sawdust. Mr. Thomson has stated that "it is common to send to the drug-grinders eighty-four pounds of jalap to be made into a hundred-weight.

Jalap, when reduced to powder, is of a dark reddish-brown colour. The odour is peculiar, and may serve to identify it. It rapidly turns brown when mixed with strong nitric acid; but if adulterated with guaiacum, as is often the case with that purchased at the chemist's shop, it becomes at first green.

Opium is the dried juice of the *Papaver somniferum*, obtained by making incisions into the head of the white poppy, and removing the exuded juice, after it has been allowed to thicken by the action of the atmosphere. The best opium is a soft brown-red mass, of a powerful bitter flavour, and strong, disagreeable odour. It is chiefly cultivated in India, Persia, and Asiatic Turkey. That which is imported from Smyrna is the most esteemed in Europe.

Some notion may be formed of the extent to which this drug is adulterated, from the fact that Mr. Herring, a wholesale chemist, stated, before the Committee on Adulteration of Food, that he would willingly give twenty shillings per pound for pure opium, whereas it was usually sold at four. On referring to the analysis of twenty-three samples of green opium, as imported, Dr. Hassall found that no less than nineteen of them were adulterated, four only being genuine. The prevailing adulterations consisted of poppy capsules, and wheat flour, but in two cases, sand; in one, sugar; and in another, gum, were discovered. The insoluble residue left from the preparation of the tincture of opium is not unfrequently dried and pulverized, and employed by druggists in the adulteration of opium powder. Sir J. Gordon asserts that what is sold as opium is very often nothing more than a compound of mixed extracts of liquorice and gentian, with pure opium. It is so diluted that it contains one-half of foreign matter. Mr. R. D. Thomson, Professor of Chemistry at St. Thomas's Hospital, asserts that he has known extract of opium mixed with extract of senna, and from thirty to sixty per cent. of water, that was sold as opium.

Opium is undoubtedly one of the most important medicines contained in the whole *Materia Medica*, and any adulteration of it must be proportionally injurious, and sometimes even fatal. In many cases of disease, opium is administered to the extent of many grains daily, and it is essential in such cases that the

opium should be good. If, in making up the prescription at the chemist's shop, adulterated opium is employed, it is impossible to calculate with any certainty upon the effect of a given quantity of any remedy, and the medical practitioner must, of course, be disappointed in the result of his medicine.

Quinine.—This alkali, obtained from Peruvian bark, is extensively used in medicine, under the form of disulphate, or, as it is commonly called, "Sulphate of Quinine." From its commercial value, this most important drug is frequently adulterated. The substances commonly employed for the purpose are water, sugar, gum, starch, ammoniacal salts, and earthy salts, such as the sulphate of lime and magnesia, or acetate of lime. (*Phil. Mag. and Ann.* iii. 111.)

Sugar may be detected by dissolving the suspected salt in water, and adding precisely so much carbonate of potash as will precipitate the quinine; for this alkali is precipitated in white flocks from its solutions by alkalies. The taste of the sugar, no longer obscured by the intense bitter of the quinine, will generally be perceived, and it may be separated from the sulphate of potash by evaporating gently to dryness, and dissolving the sugar in boiling alcohol. Gum and starch are left when the impure sulphate of quinine is digested in strong alcohol. Ammoniacal salts are discovered by the strong odour of ammonia which may be observed when the sulphate is put into a warm solution of potash. Earthy salts may be detected by burning a portion of the suspected sulphate of quinine on platina, in the open air, and examining the ashes.

Of course, all these adulterations render it extremely difficult for physicians to calculate the effects of their prescriptions upon their patients. When dealing with this medicine, the medical man has to proceed with the greatest caution, and dare not make any allowance for adulterations; for, when administered in doses of from ten to twenty grains, it acts as a poison, causing

griping pain and heat in the abdomen, with vomiting, purging, ptyalism, a febrile condition of the system, headache, giddiness, somnolency, delirium, and stupor. (*Dr. Pereira's Materia Medica*, ii. 1407.) The usual medicinal dose is from three to seven grains.

Rhubarb.—This medicinal, purgative root is imported into this country from Russia, China, and the East Indies. The rhubarb grown in this country, and so extensively used for making pies and preserves, is of Asiatic origin, and indeed the same as that cultivated in Tartary; but, in the transplanting into Europe, it has lost its medicinal properties. It is a high-priced and much-used drug, and consequently offers great temptation to the unprincipled dealer to adulterate it with worthless and cheap ingredients. A substance purporting to be "the best Turkey rhubarb" is manufactured largely in this country. Mr. Robert Warrington states that, in the neighbourhood of Banbury, there is a grower who vends upwards of twenty tons of English rhubarb in a year, to wholesale druggists. The price of the best Russia rhubarb is eleven shillings and sixpence per pound, whilst the British is only fourpence. Before being sold, this inferior substance is usually covered with powdered Turkey rhubarb. It has a certain medicinal effect, but to produce it, the dose must be enormous.

What is styled Turkey rhubarb is not grown in Turkey, but on the declivities of the great chain of mountains which separates Tartary from Siberia. The sale of it is a monopoly of the Russian Government, and only a certain number of chests are allowed to be sent out of St. Petersburg annually. Large quantities of this drug are also imported from China.

The powdered rhubarb sold at the inferior chemists' shops is frequently adulterated with flour, turmeric, and the root of the *Curcuma longa*, which yields a beautiful bright yellow colour, and is therefore employed to give a pleasing appearance to the adulterated compound. Mr. Thomson states that he has frequently

met with examples of this method of adulterating rhubarb, especially in medicines which have been sent for the supply of ships going abroad. When a hundredweight contained fourteen pounds of flour and eight ounces of turmeric, it was considered to be a good article.

The easiest test for the presence of turmeric is to make a decoction of the suspected drug, and dip strips of paper into the solution. A little soda should then be dissolved in water, and these strips, after they have been allowed to dry, should be moistened with the liquid. If the paper turns brown, turmeric has been employed for the purpose of imparting a yellow colour to the worthless compound with which the rhubarb has been adulterated. Turmeric paper is the test employed by chemists for detecting the presence of free alkali, by the action of which it receives a brown stain.

Scammony.—This highly valuable gum resin is the produce of a species of convolvulus. It is procured by making incisions into the roots, and collecting the exuding juice. The Aleppo scammony contains twice as much resin as the Smyrna, but less extractive and gum. The medicine known as the Earl of Warwick's powder, is the compound powder of scammony.

It is a very important article of the *Materia Medica*, acting as a drastic purgative, and is usually given in combination with other purgatives, such as colocynth or aloes.

From its high price, scammony is constantly adulterated. Perhaps no better criterion of the purity of a drug can be given than its price in the market. That of scammony varies from five shillings a pound to forty shillings.

The principal ingredients employed for the adulteration of this drug are the resins of guaiacum, also common resin powdered, jalap, chalk, wheat flour, and occasionally sand.

The scammony as purchased at many chemists'

shops does not contain much more than one-fourth of the pure drug, and, of course, is deficient to that extent of the active properties which it should possess.

Dr. Thomson discovered a large quantity of starch in the purest samples of scammony he was able to obtain in London. As a proof that starch was not a necessary ingredient of scammony, this same gentleman had also purchased scammony without any starch, but mixed with half its weight of chalk.

Scammony is usually seen under the form of a dark grey powder. Nitric acid turns it immediately brown. Sulphuric acid carbonizes it on contact. Iodine water acquires with it slowly a deep purple colour. A solution of potash dissolves it in part, and acquires a deep greenish-brown colour.

If therefore a small quantity of the adulterated scammony be placed in successive solutions of potash until the whole of it be dissolved, it will not be difficult, on examining the residue, to discover the ingredients which have been employed for the purposes of adulteration.

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INDEX.

INDEX—*Continued.*